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Stretching—An Important Factor Which Affects the Properties and Processing of Rayon and Cotton Materials

By **A. J. HALL, B.Sc., F.I.C., F.T.I.**

ALTHOUGH it is almost impossible to avoid subjecting textile materials to stretching forces throughout their wet and dry processing (spinning, weaving, knitting, dyeing, finishing, etc.) it is not generally recognized that such stretching may have very important effects, both temporary and permanent, on the properties of these materials. But one moment's reflection is necessary to satisfy oneself that the effects of stretching textile fibers must be far reaching. A fiber must be considered as consisting of a number of unit particles joined end to end and held together by definite forces, and if such a fiber be stretched beyond its elastic limits then the unit particles become permanently spaced differently than hitherto and must therefore be subject to different forces. Hence their changed properties.

It has long been known that textile fibers which have been subject to considerable stretching have an impaired tensile strength and elasticity, and it is not proposed to deal particularly with this aspect of stretching in this article. Rather is it desired to draw attention to some of the effects of stretching on the following properties of cotton and rayon yarns and materials:

1. Affinity for dyestuffs and moisture.
2. Increase of luster.
3. Softness.
4. Resistance to creasing.

The effect of stretching on the affinity of cellulose fibers for dyes has particular importance in the mercerization of cotton materials, the manufacture of rayon (viscose and cuprammonium types), and in the dyeing of rayon.

It is now some twenty years ago that Knecht drew attention (J. Soc. Dyers and Col., 1908, 24, 67 and 107) to the fact that cotton yarn stretched during the process of mercerization had less affinity for certain direct dyes than similar yarn similarly mercerized but without stretching. His results were as follows:

	Absorption of Benzopurpurine 4B	
	Unbleached	Bleached
	%	%
Before mercerization	1.55	1.50
After mercerization with tension	2.90	2.86
" without tension	3.39	3.54

and it is particularly pointed out that this difference between mercerization with and without tension is based not on a difference between the depths of shade of the dyed mercerized cotton yarns but on determinations of the actual amount of dye absorbed. The effect of stretching is such as to decrease the usual increase in dyeing affinity by about 12 per cent, which is considerable.

Mercerization has little effect on the affinity of cotton for basic dyes (in the absence of a mordant) and it is therefore unlikely that stretching will affect dyeing with basic dyes.

Towards the conclusion of this article the effects of stretching will be correlated with the fine structure of cotton and rayon fibers so that a discussion of the manner in which stretching during mercerization can produce a smaller increase of dyeing affinity for direct dyes will be deferred till then, but at this point it is interesting to correlate dyeing phenomenon with a somewhat similar effect produced by stretching during mercerization on the moisture absorbent properties of the resulting cotton.

It is well known that there is some peculiar relationship between the absorption by cotton of both dyes and moisture. The greater the absorption of moisture the greater the affinity for direct dyes. Before mercerization cotton has a natural moisture content of about 7 per cent; after mercerization, this is permanently raised to about 12 per cent. If the concentration of the caustic soda solution used in mercerizing is below that required to produce full mercerization then the moisture content of

the resulting poorly mercerized cotton will be proportionately lower than 12 per cent. Similarly the affinity for direct dyes is lowered. The change of moisture absorp-

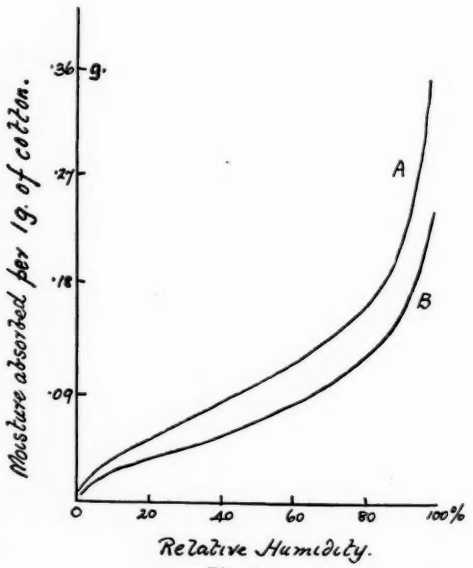

Fig. 1
A = Cotton mercerized with 15% caustic soda
B = Cotton before mercerization

tion as produced by mercerization with different concentrations of caustic soda is shown below (Urquhart and Williams; J. Text. Inst., 1924, 15, 138):

Concentration of caustic soda Tw.	Moisture absorbed by 1 gram or dry cotton at relative humidity 57% grams.
0	0.0616
20.4	0.0671
29.0	0.0957
33.0	0.0973
38.4	0.0970
55.0	0.1024
79.2	0.0900

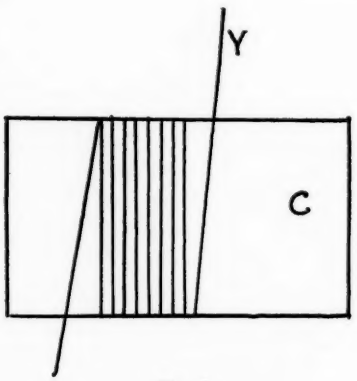

Fig. 2

It will be noticed that when the mercerization is carried out with a very high concentration of caustic soda, about 80° Tw., a smaller increase of moisture absorption is observed. This is also true as regards the dyeing affinity of the mercerized cotton; it is less than when mercerization is carried out at say 60° Tw.

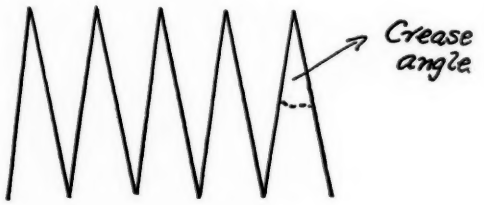

Fig. 3

The moisture absorption is, of course, dependent on the relative humidity of the surrounding atmosphere, and if a cotton mercerized with say 15 per cent caustic soda and the cotton before mercerization are together exposed to an atmosphere whose humidity is continuously increased. Then the absorption of these two cottons is as shown in Fig. 1. The interesting point about these absorptions is that the ratio of the moisture content of the mercerized cotton (without tension) to that of the original cotton

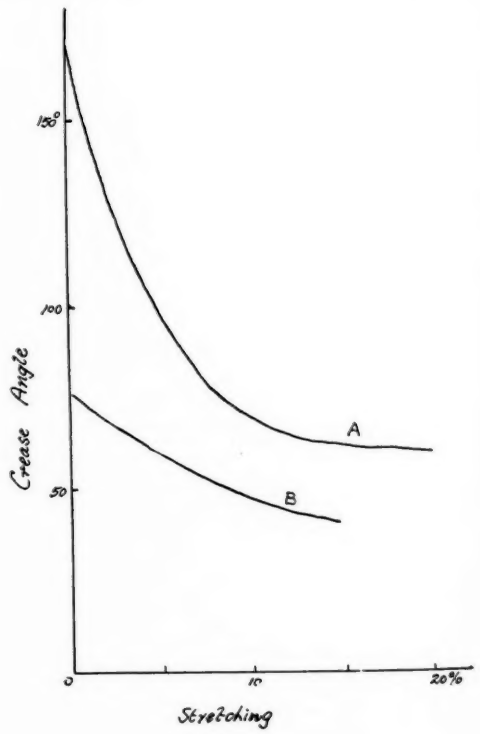

Fig. 4
A = Cellulose Acetate Rayon
B = Viscose Rayon

(soda boiled) at the same humidity is practically independent of the humidity, this ratio being about 1.57 in the case of American Upland cotton. Now in a later paper this ratio has been determined by Urguhart (J. Text. Inst., 1927, 18,55) for cottons mercerized with

and without tension and it is found that a similar generalization holds as regards the ratio of the moisture absorptions when the cotton is mercerized under tension. But the ratio is less than when mercerization is effected without tension. Thus for an American Texas cotton the ratios are as follows: :

Concentration of caustic soda used for mercerization	Moisture absorption ratios	
	With tension	Without tension
%		
15	1.22	1.38
20	1.33	1.39
25	1.36	1.42

the ratio being seen to depend to a small extent on the degree of mercerization and the type of cotton.

It is the practice of many dyers to mercerize cotton fabrics before dyeing in order to be able to dye deep shades without difficulty. This is generally the case in the dyeing of Aniline Black and Sulphur Black. The above results indicate that the least possible stretching should be employed during mercerization in order to obtain the greatest dyeing affinity.

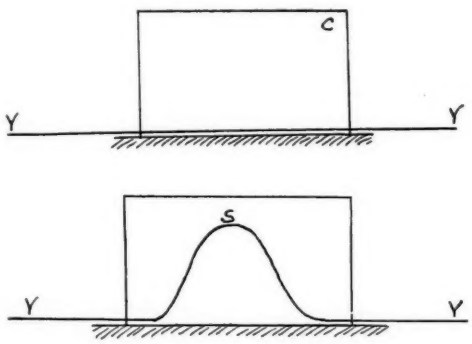

Fig. 5
Apparatus for determining the self-supporting curves of stretched Rayon yarn

It is now interesting to turn to the effect of stretching on the dyeing properties of rayon yarns. In the first place stretching has a permanent effect if carried out during the spinning of the rayon. Such stretching leads to the production of rayon which has a decreased affinity for direct dyes. The affinity decreases in proportion to the extent of the stretching. Probably a similar rule holds, but to a more limited degree, in the case of cellulose acetate rayon but this has yet to be clearly proved. But it is in the dyeing of stretched fully formed rayon that some of the most interesting phenomena are observed.

In a communication on the effect of stretching on the affinity of individual viscose filaments for direct dyes (J. Soc. Dyers and Col., 1929, 45, 97) Hall drew attention to the fact that the effect is dependent not only on the rayon itself but also on nature of the dye. Generally, viscose rayon dyed whilst in a stretched condition has a decreased affinity for direct dyes, but in the case of that limited group of dyes which are known to give even dyeings on uneven grades of viscose rayon under ordinary conditions of dyeing Hall has found that the effect of stretching is much less marked. A large number of dyes were classified according as they yielded nearly the same or markedly different depths of shade on (1) viscose rayon before and after a swelling treatment with 5 per cent caustic soda and (2) viscose rayons dyed whilst subject and not subject to stretching. The surprising fact was that these two classifications agreed exactly. Thus Chlorazol Sky Blue FF which is well known to be an uneven-dyeing color for viscose rayon gives a very pale shade on a viscose filament maintained stretched during dyeing, whilst Chrysophenine G which is equally well known to be an even-dyeing color yields an almost normal shade on the stretched viscose.

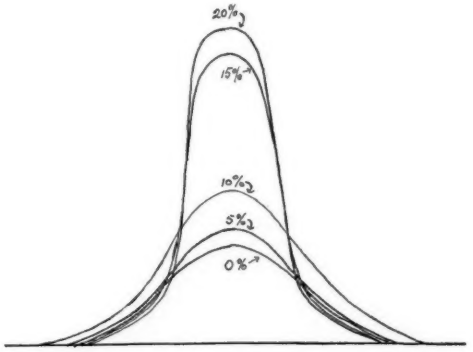

Fig. 6
Self-supporting curves for Cellulose Acetate Rayon

In contrast to the above facts very little difference as regards the resulting depth of shade was noticed in dyeing cellulose acetate rayons with and without stretching.

The effect of stretching on the luster of cotton during mercerization is well known. Unless the cotton is stretched during its treatment with the mercerizing liquor or during the washing out of the alkaline mercerizing liquor little gain of luster is obtained; with such stretching the gain of luster is considerable. During mercerization the cotton fibers tend to shrink in length and it appears that this shrinkage must be counterbalanced by stretching if luster is to be obtained. A similar condition holds for viscose rayon. By use of caustic potash (E. P. 295488) it is possible to mercerize cotton goods containing viscose rayon without damaging the latter, but the process does lead to shrinkage of the rayon. If this shrinkage is not prevented by suitable stretching the rayon loses a part of its original luster.

In the dry condition it is difficult to stretch cotton yarns; during such stretching the individual fibers slide over each other and thus accommodate the stretching without themselves being stretched. On the other hand rayon yarns consist of very long individual fibers and by stretching the yarn it is possible to stretch the individual fibers. Such stretching appears to increase the luster of the rayon. In weaving and knitting it occasionally happens that

certain rayon yarns are locally stretched excessively. In the manufactured material these stretched yarns stand out from the others by reason of their high luster and so give rise to luster defects.

The luster of viscose rayon can also be increased by stretching during the spinning process or by drying the freshly formed yarn under stretching. If dull luster yarn is required then such stretching must be reduced as much as possible.

The effect of stretching cellulose acetate rayon affects its luster in a somewhat indirect manner. This type of rayon is slightly ductile and although it becomes more lustrous when stretched in its dry and fully formed condition this increase is not so great as the corresponding increase in the case of viscose rayon. But stretching has a permanent effect on the luster of cellulose acetate rayon. This type of rayon readily loses its luster when boiled for a few minutes in water, particularly if a small amount of soap is present. This is sometimes a disadvantage. Now Hall has found that if the rayon be first stretched then it has a smaller tendency to lose luster when treated with boiling liquors. The greater the stretching the greater the resistance to loss of luster. An ordinary cellulose acetate rayon yarn can be stretched without breakage by about 15-20 per cent, but if it be first treated with a swelling agent and so made more ductile considerably greater stretching can be effected. Hall (E. P. 277089) uses a number of swelling agents, mostly in the form of a 10-20 per cent aqueous solution, and among these are formaldehyde, acetic acid, alcohol, glycerine, and acetone. With this increased stretching the cellulose acetate rayon can be made to resist loss of luster even when boiled for a prolonged period.

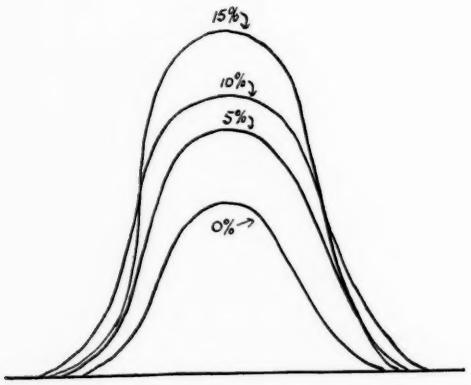

Fig. 7
Self-supporting curves for Viscose Rayon

It is obvious that this stretching of cellulose acetate rayon could be most advantageously carried out during the actual spinning process, that is, whilst the yarn is in a very ductile condition. This has been tried and the process of stretching has recently been protected.

Hitherto not much attention has been paid to the softness and creasing properties of rayons although these are of the greatest importance in connection with rayon materials used for dress purposes. Recently however Hall has carried out a number of investigations which show that these two properties—creasing and softness—are intimately affected by the stretching to which the rayon may be subject.

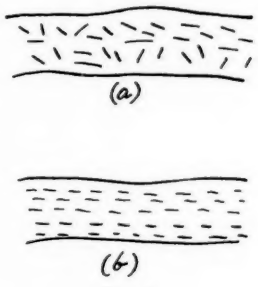

Fig. 8
Arrangement of micelles in non-stretched (a) and stretched (b) Viscose Rayon Filaments

In these investigations both viscose and cellulose acetate rayon yarns were employed. Creasing was examined by winding stretched yarn around a cardboard strip c as shown in Fig. 2 and then pressing this under a known weight; on carefully removing the yarn from the cardboard the yarn retained its shape (crease-trace) as shown in Fig. 3. In the crease-trace the crease angle is inversely proportional to the creasability of the rayon and it was found that the crease angle was smaller as the stretching was increased. In other words, stretching of both viscose and cellulose acetate rayon yarns decreases their resistance to creasing. Some of the results are shown below, and in Fig. 4.

Cellulose acetate rayon:

Degree of stretching %	Crease angle degrees approx.
0	170
5	101
10	67
15	62
20	61

Viscose rayon:

Degree of stretching %	Crease angle degrees approx.
0	74
5	57
10	50
15	41.5

It is evident that a small stretching is sufficient to decrease seriously the resistance of both viscose and cellulose acetate rayon yarns to creasing but the effect is particularly marked in the case of cellulose acetate rayon.

The softness of viscose and cellulose acetate rayons was measured by Hall, using a new method which in fact is a measure of rigidity as produced by stretching. A length of the yarn Y placed horizontally (Fig 5a) in

front of a vertical sheet of cardboard C standing on a polished plate of glass or other smooth material is raised from its central point S and then allowed to support itself; the yarn will then take a form as shown in Fig 5b this being called the 'self-supporting' curve. These self-supporting curves were determined for different degrees of stretching of the yarns and are shown in Figs 6 and 7.

The effect of stretching is seen to give greater rigidity to either type of rayon as reflected in larger self-supporting curves. A small amount of stretching has an appreciable influence.

These investigations readily show that the value of rayon materials can be seriously reduced by stretching. This can take place in the winding of the yarn previous to its use in weaving and knitting as well as in these subsequent operations. Also in the finishing of the dyed rayon materials it is usual to use stretching processes. All such stretching should be reduced to the lowest amount possible if it is desired to retain all the valuable properties—softness and resistance to creasing—of the rayon.

The question may now be asked why it is that stretching should have such an important influence on the properties of rayons. Of course a complete answer cannot be given in view of the inadequate knowledge we have, as yet, of the fine structure of rayon filaments, but there is sufficient evidence to make it likely that these changes as produced by stretching are due to the resulting rearrangement of the micelles of cellulose or cellulose acetate which make up the filaments.

It is believed that in an ordinary rayon filament the micelles are arranged higgledy piggledy as shown in Fig 8a. With stretching, these micelles are brought more parallel to each other as shown in Fig 8b. With the greater parallelism the filament becomes more compact thus having a diminished active surface and therefore having less affinity for dyes and moisture. Also if it be assumed that the forces holding the micelles together are greatest between the ends of the micelles then the stretched rayon having the form shown in Fig 8b will have a greater tensile strength and less extensibility than the rayon shown in Fig 8a. These facts are true since it is known that the stretching of viscose rayon in its process of spinning gives it a greater strength accompanied by a decreased extensibility.

It is also probable that the micelles are concerned with the reflection and absorption of light. A bundle of parallel glass threads has more luster than one composed of threads twisted about each other. Thus with the rayon filament—the greater parallelism of the micelles as produced by stretching increases the luster of the rayon.

The stretching of rayon materials is a matter of concern to many interested parties—the manufacturer of rayon, those who wind and spin the yarn, knitters, weavers, and dyers and finishers. It also has an interest for rayon machine makers since their machines should be adapted to work with the least stretching of the rayon. In short, stretching and its results are worthy of considerable further research.

German Dye Trust Report for 1929

The annual report of the German Dye Trust reveals a net profit of 104,597,000 marks, a profit of approximately 14,000,000 marks lower than that for 1928. However, this made available a 12 per cent dividend on its common share capital, and in addition to this regular dividend I. G. Farbenindustrie A. G. will pay a 2 per cent bonus on the common stock from funds received from the United States Alien Property Custodian for property seized during the World War.

The Trust's stock capital for 1929 remained unchanged at 1,100,000,000 marks. The reserve funds totaled 200,000,000 marks, 12,000,000 marks more than for the preceeding year. Deposits with the banks, compared with the preceeding year, were 91,000,000 marks less, but on the other hand, debts contracted with the banks also decreased 51,000,000 marks. Outstanding debts with affiliated concerns totaled 90,000,000 marks against 75,000,000 for 1928. With other concerns, the debts decreased by 30,000,000 marks. Accounts payable to affiliated firms declined 23,000,000 marks and accounts payable to other concerns decreased only 11,000,000 marks.

As stated in the report, the business depression which became quite pronounced in 1929, adversely influenced production and sales of I. G. products. The depression was at its heights at the end of 1929 and the first of the current year, however, a slight improvement has been noticed in recent months. The total sales turnover was equal to that of 1928, and in spite of the depression, the report regards the business results of the year as satisfactory.

R. & H. Outing

The Roessler and Hasslacher Chemical Co. held its annual sales and service convention at Niagara Falls on June 9, 10, 11. In attendance were executives from the company's manufacturing plants and New York offices, district sales managers, sales and service men from the various branches in the United States, Canada, and Mexico. The convention was presided over by Dr. H. R. Carveth, president of the company.

Activities of the convention included inspection tours about the Niagara Falls plant, visits being made to several of the process departments. The business sessions were featured by pertinent papers discussing manufacture, service and sales of R. & H. products.

The annual banquet was held on the evening of June 10 at the General Brock Hotel, Niagara Falls, Ont. The speaker of the evening was J. E. Hatt, general manager of the du Pont Cellophane Co., New York.

Straw and Tagal Bleaching and Dyeing

Part II.—Bleaching and Dyeing

By **FRED. GROVE-PALMER, A.I.C.**

STRAW bleaching has long been practised; it is one of the many old textile arts that were formerly regarded as mysteries: almost every bleachery had its own particular "trade-secrets" which, when boiled down, differed very little from those of the place next door. Skilled bleachers were "bought" by rival firms and there was ill-feeling in consequence. At present, in spite of widely differing opinions as to the best method to be employed, the processes are carried out on a more or less scientific basis.

Although it is now very difficult to state with accuracy to what extent it was ever standardized, the so-called "Luton" bleach was regarded as being the one that gave the finest results, and certainly the volume of sales in all parts of the world seems to have justified the impression. The method adopted by one chemist some twenty odd years ago was on the following lines:

The straw was cleaned thoroughly in soap and water, wooden vats being used; it then received a second washing in a weak solution of oxalic acid. The liquor was drained off and the damp straw was hung in a stove, tightly closed, to be treated with sulphur dioxide derived from burning sulphur. The next step was exposure to sunlight to dry off and complete the bleach so far as possible, but it practically always required a further damping and another sulphur treatment.

The same method or some variant of it is still employed in many bleach works although there is no doubt that after a comparatively short exposure to the sunlight in the course of wear, the straw tends to revert to its original yellowish color. The users hold, perhaps with a certain amount of justification, that straw hats are not intended for everlasting wear, they retain the whiteness sufficiently long for the purpose and may then be cast aside; therefore, a cheap process which gives a good result for a short time is all that is necessary. Hydrogen peroxide bleach, which is more expensive, gives a more lasting result. Chlorine is usually looked upon as being too apt to cause disintegration of the fiber but it has been used quite freely. Gustav Funke, in "Lehrbuch für Korbflechter," published in Vienna in 1911, describes a bleaching powder process then in use among the Austrian straw bleachers. The method is interesting but if it is to be tried out, the present writer strongly advises working on small experimental batches as the figures given do not look at all inviting.

(1) Soak the straw in an alkaline bath containing 16 pounds of caustic potash and 24 pounds of caustic soda in 12 gallons of water. This will give a lye having specific gravity of about 1.5. The straw is kept in this for one hour and is then given several good washes in warm water, after which it is lifted and allowed to drain.

(2) Soak in a bleach liquor made with 10 pounds of bleaching powder stirred up in 12 gallons of water until the desired color is reached.

(3) After rinsing, work in a bath of some antichlor, wash well and dry in the air.

That strong measures are necessary there is no doubt, owing to the hard, siliceous outer coating of the majority of straws which makes them impervious to gentle treatment either by bleaching or of dyeing.

For this reason, strongly alkaline solutions of hydrogen peroxide have found considerable favor. Another mixed method of bleaching, which is mentioned below, has been popular among works doing a big export trade:

The straw is soaked for an indefinite period in a bath containing 1½ pounds of oxalic acid in 12 gallons of water, to which is added in small quantities at a time 1 pound of sodium peroxide; a further addition is made, also in small quantities, of 1½ pounds of sodium silicate. This is diluted with water before adding so as to facilitate mixture, the whole being well stirred all the while. The straw is kept soaking in the alkaline bath until such time as the color is sufficiently discharged, when it is lifted and drained, and then plunged into a dilute solution of tartaric acid or a solution of four ounces of concentrated sulphuric acid in 4½ gallons of water to neutralize the alkali.

A modification of this method has been suggested by the Badische Anilin Company: they advocate the introduction of a bath of 1 pound of Blankit (Hydrosulfite) in 12 gallons of water, after lifting from the first bleach liquor. This bath can be used again if refreshed.

When straw has been well rinsed, it is dried at a low temperature, a proceeding that is followed generally throughout the industry in order to prevent the fiber from becoming brittle as usually occurs if too much heat is employed.

The foregoing baths are used cold but the method suggested by Konigswater and Ebell, is to work in baths of double strength at a temperature between 20 and 25

deg. C. This does the work in much less time. Softened water is used for washing.

The method of Beutel and Marigold, as mentioned in Farb.-Zeit., 25, p. 136, requires a preliminary soaking in a hot solution of potassium chlorate, and after draining, a plunge into hot potassium bichromate solution. The straw is then stoved in sulphur dioxide fumes for two days and nights, rinsed and again stoved for the same length of time. In addition to straw, this plan has been found useful for split and skinned canes, split reeds, barked willow, chip and raffia. It is claimed that less skilled supervision is needed in this process than in the case of peroxides, hydrosulphites and chlor bleaches; in addition it is cheap to use.

At the same time it should be borne in mind that straw bleached with sulphur dioxide, as has been pointed out by Farrell and Walker, in "Dyeing and Cleaning," London, 1929, is not good when dyeing is to follow; it is far safer to use an oxalic acid bath, or alternatively, soaking in a solution of potassium permanganate and subsequently in either sulphuric or oxalic acid, which gives excellent results.

It is quite natural to find that much research work on the bleaching of straws and other vegetable fibers has been done by the Japanese investigators, arising from the large trade in hats and braids, in which they have succeeded in getting a hold on the greater part of the world's business.

The Yamamoto bleaching process is to soak in a weak solution of bleaching powder and oxalic acid (1.5 kilograms of each in 200 liters of water) for three days, and then in a bath containing the acid only for a similar period. This is very useful for raffia and, though the writer has not tested it personally, it would probably answer for other fibers also. Cocoanut fiber has been attracting attention as a material for hats; this is not the ordinary coir of commerce but the fiber extracted from the leaves of the cocoanut palms. Miyake's method of bleaching these is to boil for two hours in 5 to 10 per cent bath of sodium carbonate (dry) and when the fiber is drained, bleaching it for three or four days in the following liquor:

Sodium peroxide	3 pounds
Potassium oxalate	2 pounds
Sulphuric acid	6 pounds
Water (soft)	12 gallons

Carludovica palmata, the Panama hat grass, is meeting with much competition from the Japanese plant known as Kuroharii, black needle-grass. S. Aoki's process for bleaching this is to soak for a day or so in a weak solution of magnesium sulphate (around 2 per cent is advised), then bleach in a liquor containing 1 per cent of sodium peroxide and 3 per cent of sodium silicate in soft water at 40 deg. C. This takes a few hours. When the grass has been washed it is further treated for 10 hours in a bath containing 2 per cent each of sodium bisulphate, oxalic acid and alum. Lifted from that and drained, it is immersed without intermediate washing and boiled in 2 per cent alum. This is a process that may well find an extended application.

Dyeing

Like bleaching, straw dyeing has also had its mystery days when beautiful colors were produced by means of such old-time relics as madder, fustic, indigo, and logwood. Some logwood is still used at times, but the others have long departed. The process of dyeing took a long time and was a highly skilled job handed down from father to son. It was enough to get the color on, no mean task, by the way, and its fastness to rain or to sunlight were not matters that greatly troubled the dyer. His work was to get the stuff out and so long as the brilliance of the tint, the evenness of the shade and the penetration were good, he was not expected to do more. The work was done then, as now, in wooden or copper vats with perforated steam coils under the false bottoms, and a lid of copper, also perforated to weight the straw under the liquor. The old custom of stringing still is maintained whereby the plait is wound around a stick and hung in the dye liquor by a string loop; they still speak of a dyed batch as a tally.

The old sugar finish is now glucose, which is applied in a thin paste of farina or starch; this gives extra luster and assists in preventing the rubbing off of the dyestuff. More even colors are produced on braids than on the straw before plaiting, though when the plait is to be in mixed tints or in speckles, the dyeing must be done first. For this purpose, the splits are tied up in bundles measuring five inches in diameter, which are stood up in the liquor or, in some cases, when a more concentrated color solution is used it is pumped through the loaded vat.

It is the hard skin of straw containing appreciable quantities of silica derived from the soil that makes the fiber difficult to dye and renders leveling a work that tasks the dyer's skill.

When the bleached straw or plait is to be dyed it must first be thoroughly soaked or wetted out. This may be accomplished by boiling for an hour or two in water containing 0.5 per cent of sodium acetate calculated on the weight of straw; the effect of this, apart from the wetting, is the yellowing of the color but that can be made paler by putting in a small amount of tartaric acid. Some dyers prefer to wet out in a batch of sodium bisulphate containing about 1 to 3 ounces to the gallon; others again leave it in plain boiling water over night.

Almost any dyestuff will give reasonable results with straws. Because of the difficulty of penetration to which allusion has just been made, it is necessary to slow up the operation as much as possible in order to allow the color to get well fixed.

Basic colors are very largely used because of their brightness, the strong tinctorial power and the comparatively low cost. The wetted straw or other fiber is entered into a moderately warm bath acidified with tartaric, acetic or formic acid; less of the first is wanted than of the other two, but it costs more per pound. The bath is slowly brought to boiling point and that temperature is maintained for about three hours. Every now and then a little more acid may be added to help penetration and the

exhaustion of the liquor. Heavy colors are left all night to feed in the cooling bath. Many workers find that it helps in leveling if they add the dye solution in parts during the earlier stages of the process. Others, again, prefer to work with a boiling bath at the beginning, especially when dyeing pale shades; in such cases the temperature needs keeping up for two hours or so.

The great disadvantage of this class of dyestuffs is their fugitive nature when exposed to daylight but, that failing apart, the majority of them can be used in straw dyeing. One exception is Auramine; this is easily decomposed in the boiling bath and for that reason should be omitted from the formula, being replaced with either Thioflavine T, Acronol Yellow T or some other stable dye. Although it is not of any particular use to mention all the basic dyes that may be employed for straw dyeing, those given below have been found of special value in the production of the present mode shades:

Phosphine 3R
Acridine Orange LP New
Safranine T extra
Irisamine
Rhodyle
Crystal Violet Powder
Indazine
Mignonette
Methylene Blue ZX
Cerise 79456 YS
Leather Brown
Acronol Indigo
Victoria Green Small Crystals

Very attractive iridescent colors can be obtained on straws by means of a formula in which one or other of the basic Thioflavines is combined with one of the Methyl Violets.

Although straws, as a general rule, do not take up the acid dyestuffs so well as they do the basic colors, many dyers use them on account of their greater fastness to light, even though the tints are much less bright. The method of application is similar to that given for the former class, though in some dyehouses, the baths are used very short and without the assistance of acid; in such cases, it is customary to enter at the boil and maintain this temperature throughout the whole of the six hours' immersion. There is no doubt that the addition of a small quantity of acid, especially towards the end of the operation helps in exhausting the color from the liquor.

Tagal and Chip

The substantive dyestuffs are principally used for tagal, tagal picots or pedal tagals, and willow chips. Except in the case of black they are of little service to the ordinary straw dyer, but for these special purposes some very elegant tints can be produced. This holds good for nearly all the members of this large class of colors but it is necessary for the dyer to pick out those which have the greatest powers of penetration.

The most usually adopted method of dyeing is to immerse the wetted plait in a concentrated boiling bath to which anything from ten to thirty per cent of Glauber salt has been added; in some dyesheds an addition of 5 per cent of soap, or 1 per cent of either dry sodium carbonate or borax is favored. Baths are kept at the boil for an hour or even two to ensure leveling and exhaustion. A long range of good colors and mode shades can be produced with the substantive dyes.

The dyeing of tagal and wood chip is not restricted to this class of dyestuffs; all those that will go onto straws will succeed equally well on these fibers; though the reverse does not necessarily hold good.

Two-Color Effects

Mixtures of two shades and speckles for use in straw hats are obtained by dyeing the fiber previously to plaiting; the latter before splitting. Sulphur dyes can be used for men's hats, the favorite shades being black, green, blue and brown.

Dyeing with sulphur colors is not difficult. The liquor is made by dissolving the dyestuff in an equal weight of crystallized sodium sulphide; generally speaking the concentration of the bath runs from 1 to 3 lb. of dye to 12 gallons of water. The working temperature should be around 20 deg. C. and time of immersion about 30 minutes. If 2 lbs. of Glauber salt and ½ lb. of dry sodium carbonate are added it ensures better penetration. When the desired color is attained, the goods are very thoroughly washed in both hot and cold rinse to ensure complete removal of all adhering dye, and dried at low temperature or in the air. They are then split. In order to clear off all trace of dye from the interiors, the straws are soaked for an hour or more in the following acid bath:

Sulphuric Acid (Concentrated) ...	4 oz.
Sodium bisulphite	4 oz.
Water	12 gallons.

The temperature of this should be 80 deg. C.; the soaking is followed by further rinsings and when the straw is to be used for speckles, demanding a white side, they are simply dried as before. For the second color, the method adopted for acid dyeing is now used.

Modern practice has shown that always better results are produced when softened water is used. The reason for this is if there are any lime or magnesia salts present they react with the siliceous coating of the straw and form an almost imperviously waterproof cement.

In general when dealing with chips greater care must be exercised on account of the greater brittleness; this applies equally to dyeing and drying.

Increased brightness may be obtained on the sulphur dyes, which are naturally inclined to dullness, by topping off with basic colors. These, it will have been noted, are applied without the preliminary mordanting process, owing to the fact that the presence of a certain quantity of tannin in the straw acts in lieu thereof.

This property has a rather interesting historical significance: it will be recalled that the Israelites complained that they could not make bricks without straw, a complaint that for generations puzzled the world. It was left to Acheson, of graphite fame, to discover that the reason for the need for straw was that the tannin it contains reacts

with certain colloidal bodies in the clay and produces the tenacity or 'cling' necessary for brickmaking.

Returning to the dyeing of straw with basic colors, the same effect of tannin is noticed in the jute industry. Owing to the varying quantities of this substance present in different fibers, the actual shade produced by any dye, especially in pale tints, will not be like that on another batch of plait, and when it is necessary to match up several lots of braids this point should not be forgotten.

In handling the present day crinolines which are made of viscose or celanese, it requires very much greater care in all stages of the wet treatment to get them through without damage, owing to the low tensile strength of the fiber when damp.

In order to produce a high degree of luster on satin chip, made of willow slips mingled with rayon, the braids are coated with a composition in which glue is the predominating feature. To prevent this from being dissolved off in the subsequent dyebath, it is as well to make the glue insoluble in warm solutions by exposing it to the action of the vapor of formaldehyde. This is usually done by hanging the loose hanks of braid in a cot in which the ordinary commercial solution of formaldehyde is being heated over a small gas flame. About thirty minutes or even less than that is long enough to devote to this operation. If this treatment is not adopted, it will be found necessary to redress the crinoline braids after dyeing.

Cellulose Lacquers

Just as the cellulose lacquers and enamels have gotten a firm hold on the automobile and furniture industries, among others, so they have made a deep impression on the straw hat trade, and in addition, upon the manufacture of basketwares, cane chairs, and similar articles. Very beautiful and artistic effects can be produced by these means with a minimum of trouble. Quite young girls can be employed in the work and in a very short time they become wonderfully expert in turning out really elegant designs.

The method generally adopted is to spray the hood with a ground coat of the chosen color and then to overspray the pattern or ornamentation. This may be done through stencils if a large number of hats is wanted in one design, but it is far preferable to give the sprayers an idea of what is wanted and to let them get busy with their variations on the theme. In this way, each hat will be different from the remainder and therefore more valuable; for the purposes of the sales talk it may be regarded as a work of art the replica of which does not exist in the world.

Some years ago a number of very cheap hat enamels appeared on the market and some hat makers who tried found them very disappointing. This was because quality had been sacrificed to cost, and also because the compounders thought that any old enamel would do for straw so long as it was cheap. This is a grave mistake; the hard, siliceous outercovering of straws and grasses, generally, forms a groundwork upon which cellulose enamels find it exceedingly difficult to cling. The result was that at the least scrape of the nail or anything else, these cheap formulations would flake off and leave an unsightly white patch. Many a batch of sprayed hats was rejected on this account and makers found that their attempts to produce good work with cheap material had once again met with disaster.

Properly compounded by enamel manufacturers who know the requirements of the hat trade, there is no difficulty in finding a market for cellulose lacquers that will stick to straw quite serviceably. Once it is proved to the hat maker that his troubles are overcome, there is no doubt as to the saleability of the compositions. A very interesting line of hats that has proved and still is proving popular is one in which the design, if it may be so called, consists of irregular streaks and lines flecked all over the hood in a color at direct contrast with the groundcoat.

The added weight of the enamel and its flexibility when dry are two other important points to be looked for, but they, too, are easily countered and arranged for, and many hat and basket makers are finding that the time and trouble saved by this process in comparison with the bleaching and dyeing are well worth extended adoption of the more modern method.

Uncle Sam—Advisor on Packing and Shipping

By Waldon Fawcett

EMBOLDENED by his success, over a period of years, as counsel on export packing, Uncle Sam has entered upon a career as advisor on domestic packing and shipping. By means of a special agency, operated as a section of the Transportation Division of the U. S. Bureau of Foreign and Domestic Commerce, the Federal Government has undertaken to perform systematically for private industry what it did so effectually in its own interest during the World War when confronted with the problem of finding the best means of wrapping, bundling and crating all manner of commodities destined for the American military and naval forces.

The outstanding feature of the current and prospective work, in the direction of practicability, is the system of specialization on which it is organized. Keenly conscious of the fact that there are few general, broadly-applicable rules for shipping and packaging, and that such fundamentals are already well known, the Commerce specialists have undertaken to approach the problem via specific commodity channels. In each project, the objective is the best possible means and the most serviceable media for the parceling and protection in conveyance of a particular class of goods. This policy is controlling in the research on export packing as well as in the domestic sector. Incidentally, it may be remarked that the new program of exploration in the domestic packing field, starting on July 1, 1930, is matched by a revision and amplification of the Department's formulae for packing for international trade.

Several fresh influences—each revealing the prospect of calls upon the Department for aid and advice—have operated to urge the Commerce organization to devote more attention to the technical problems of domestic shipping and packing. One of the new developments is the growth of airplane transportation. It is assumed that the time is all but at hand when emergency shipments of various commodities, chemicals being among the number, will be made by air express. Aerial transit involves, presumably, its own stresses, shocks and strains, and already there is a call for containers and processes of packaging suited to these new hazards.

Another incentive to reexamination of packing precepts is found in the introduction by the railroads of the so-called container car, and the merchandise containers which afford through transit without rehandling. One of the claims made for the merchandise container is that it will, by the superior protection afforded and the immunity from rehandling, permit economies by the use of less cumbersome and less expensive interior and exterior packing. Impartial appraisal of these claims is awaited, together with definite information as to what concessions are permissable and compatible with safety to shipments. The need of a definite schedule of packing "tolerances" for the new medium is emphasized anew by the introduction, this few weeks since, of the drop-side container-car which permits the merchandise containers to be removed from the container-car by lift trucks, enabling consignments from the shipping centers to be dropped at way points.

A third spur to inquisitiveness at the Department of Commerce regarding modern standards of packing and shipping has been supplied by the Department's own plans for a thorough study of inland waterway transportation. President Hoover, in consequence of inspirations which came to him during his service as Secretary of Commerce, is particularly interested in the survey designed to pave the way for more effective utilization of the canals, navigable rivers and other inland waterways. A new era in inland waterway transportation, should it come, will have a sequel in the problems in packing and shipping, even as the unfolding of motor truck transportation has already had its reactions upon unit packing. The Department aims to be ready to tell inquirers what arrangements or accommodations in the "dress" and fastenings of shipments will discount the new conditions.

In its domestic program, as in the export program undertaken earlier, the Department will, in the compilation of its confidential data, follow commodity lines. Thus the Packing and Transportation offices will aim to have, in their files, information which will meet the most pointed inquiries of a shipper of dyestuffs or any other merchandise item. Basicly speaking, however, the set-up of this intelligence service will deal with the subject from the angle of the several types of containers. It is notorious that in no other line is there existent, today, keener inter-industrial competition than characterizes the container industries. The rivalry between fiber and wood, and between metal and glass receptacles has, in many instances, left laymen so mystified as to comparative merits that the opinion of Federal specialists is sought as being neutral and unbiased.

By and large, the Commerce Department is, in its continued undertaking, engaged in an educational campaign designed to acquaint the public in general, and shippers in particular, with the best shipping practices. In order that advice may be authoritative, the Department organized, some years since, an Advisory Board on Domestic Packing made up of representatives of the leading container industries, shippers, and transportation experts. The function of this council is to co-operate with the Department in investigating and recommending to shippers, the containers whose use would tend to minimize losses and assure safe delivery of merchandise. The purpose, then, of this whole project has been not merely to avoid the costly wastes which have, in the past, been involved in the improper packing and handling of merchandise, but likewise to reduce the risks of pilferage.

The backbone of the Federal service for domestic shipment is to acquaint each shipper with the construction of the various types of containers in order that he may select the one best suited to his need. To that end the Department is issuing a series of bulletins or handbooks devoted to the several types of packages in general use. Each manual is prepared with the assistance of subcommittees made up of leaders in the field of the particular type of container discussed. The series is not complete but there are available at this writing the numbers covering fiber containers, wooden boxes, paper-wrapped parcels for shipment by express or parcel post, cleated plywood boxes, wire-bound boxes, cooperage and steel barrels, baling, nailed wooden crates, etc. The latter part of 1930 is expected to see the completion of the series by the issuance of guides on strapping, marking, etc.

Compilation of these descriptive catalogues as a "background" for the determination of individual packing policies, is not to be construed in any sense, as a gesture in behalf of standardization of packing. On the contrary, the Packing Section of the Transportation Division prides itself on securing and disseminating detailed information and photographs of new developments in packing for foreign and domestic marketing. Especially close scrutiny is maintained on the methods employed by European shippers in both their domestic and overseas operations and members of the American chemical industries are promptly acquainted with any departures from the conventional introduced by their continental competitors. In conclusion it may be noted that the Packaging Staff, at Commerce headquarters is in position, thanks to intimate association with other units of the Transportation Divison, to sense promptly the effect, if any, upon packing practices of the new conditions in domestic warehousing. Certain students of distribution have lately advanced the theory that the changing status of the merchandise warehouse is destined to be reflected in a revision of packaging fashions and container forms.

Elementary Textile Microscopy

Part III—Identifications

Starch—Authentic Samples — Examination—Rice— Corn—Wheat—Tapioca— Potato—Arrowroot—Sago Fibers—Classifications—Textile Fibers—Wool and Hair—Mohair—Camel Hair—Minor Hair Fibers—Shoddy

By **JOHN H. SKINKLE**

Department of Chemistry, Lowell Textile Institute

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(Continued from issue of June 23, 1930.)

WHEN starches are to be examined, standard authentic samples should always be available. Sometimes it is necessary for the microscopist to prepare these himself from the grain or root. In the case of a grain, it is crushed in a mortar in the presence of water and the resulting milky solution, after being filtered through cotton cloth to remove the husk is allowed to settle in a beaker. After settling, the supernatant liquor is poured off, more water is added with agitation and the solution again allowed to settle. This is repeated until all the gluten and foreign matter is removed; the starch is then air-dried, pulverized, and stored in stoppered bottles.

In the case of a root, such as potato, a similar procedure is followed except that the crushing is preceded by slicing the root into small pieces or passing it through an ordinary meat grinder.

Starch—Examination

The unknown starch is powdered, if it is not already in a finely divided state; a small amount is taken on the point of a needle, placed on a slide, a drop of water added, and a cover glass placed on the drop.

The identification of a starch depends upon three properties of the starch granules—size, shape, and hilum. Using a magnification of about 100 x, in order to obtain a fairly large field, the starch is examined for uniformity of size and shape; usually a mixture of starches may be detected at this point; then with a magnification of 200 to 400 diameters, individual grains are examined as to shape and hilum. The shapes of the various grains may be described as polygonal (having a number of straight sides), circular, or elliptical. The circular or elliptical grains may, in some cases, be truncated (having one straight side and an arc of a circle or ellipse). The hilum is a marking sometimes present in a starch grain due to more or less rupturing of the outside case of the starch granule; the position of the hilum is sometimes important but usually the shape is of most interest. Hila may be dot, transverse (line), or stellate (two or more intersecting lines), in shape according to the variety of the starch and the age or treatment. A starch which normally has a dot hilum may on ageing or hydrolysis become transverse or even stellate and similarly a transverse may become stellate.

In the case of "modified" or soluble starches, the hilum has passed through the stellate stage and some or all of the grains have been totally ruptured. In this case, the determination of the origin of the starch must be based on the starch grains left unruptured.

The two starches most commonly used in the textile industry are corn and potato; if we add to these rice, wheat, tapioca, arrowroot, and sago practically all textile starches will be covered. For the properties of the other varieties of starches, which are very seldom met with, the student is referred to Hanausek-Winton's "Microscopy of Technical Products."

Starch—Rice

The rice starch grains are small in size (3-10μ) and are distinctly polygonal in shape. At magnifications up to

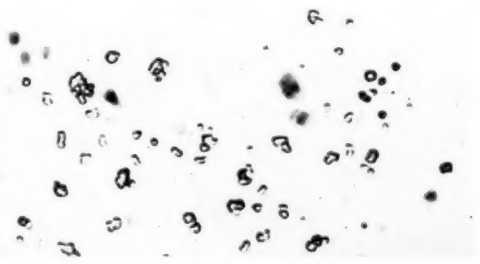


Fig. 40. Rice Starch (200x)

400 x, no hila are visible; but at higher magnifications, small dot hila appear.

STARCH—CORN

Corn starch granules are small to medium in size (10-30μ), polygonal in shape and have stellate hila.

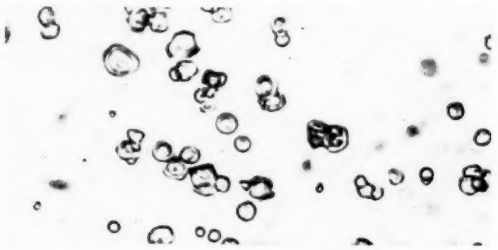


Fig. 41. Corn Starch (200x)

STARCH—WHEAT

Wheat starch is of two sizes—the small (1-8μ), and the large (15-45μ), intermediate sizes are nearly always

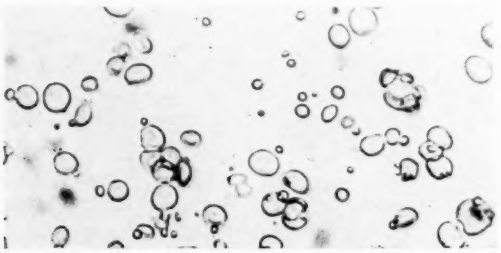


Fig. 42. Wheat Starch (200x)

lacking. The shape is circular and hila are absent unless a grain is seen on edge, in which case the shape is elliptical and a cleft appears to be present.

STARCH—TAPIOCA

Tapioca or cassava starch is small to medium (5-26μ) in size. The shape is circular with truncations present,

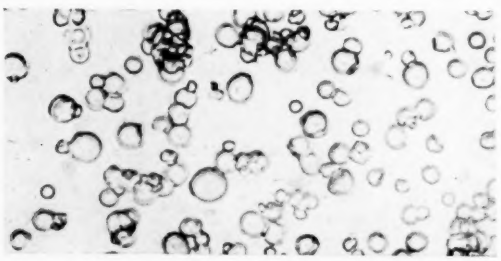


Fig. 43. Tapioca Starch (200x)

two grains are sometimes joined on their truncated sides. The hilum ordinarily consists of a dot in the center of the grains.

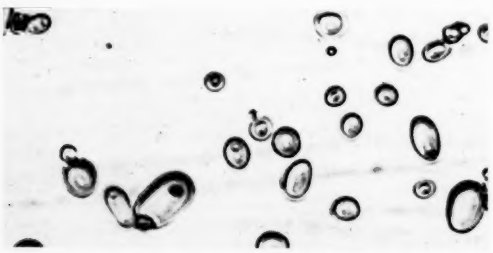


Fig. 44. Potato Starch (200x)

STARCH—POTATO

Potato starch grains are of all sizes of which the small and medium grains are circular in shape and the large ones are elliptical. The hilum is present in the larger grains as a dot at one end of the granule.

STARCH—ARROWROOT

Arrowroot starch grains are medium to large in size (35-70μ long), elliptical in shape and with a dot or transverse hilum.

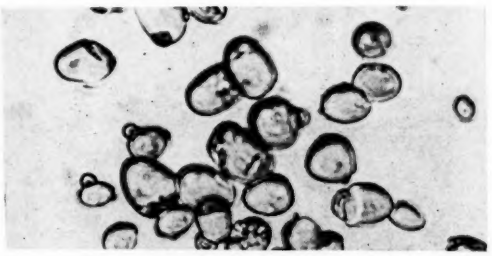


Fig. 45. Arrowroot Starch (200x)

STARCH—SAGO

Sago starch grains are medium to large in size (30-65μ), and are elliptical in shape with one or more truncations. The hila are dot or transverse and may be either at one end or in the center.

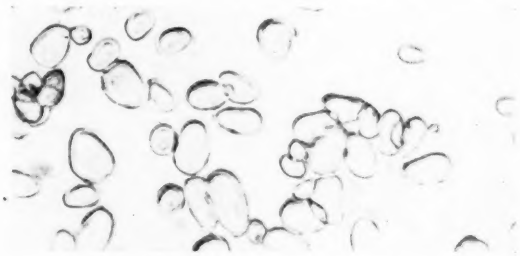


Fig. 46. Sago Starch (200x)

FIBERS—CLASSIFICATION

The textile fibers may be classified broadly as natural, artificial, and modified; and subdivided in each case into animal, vegetable and mineral fibers. The following table gives such a classification with examples of each class. Some fibers, such as wires and tinsels, may be identified without a microscope and others may be easily identified by some characteristic property (such as incombustibility of asbestos) so that a description of the microscopic appearances of only the more common fibers will be given.

TEXTILE FIBERS

A. Natural:
   1. Animal—
      a. Hairs—wool, mohair, camel, alpaca, vicuna, llama, goat, cow, horse, rabbit;
      b. Secretion of insects—true silk, tussah silk;
      c. Secretion of molluscs—sea silk.
   2. Vegetable—
      a. Hair—cotton, kapok;
      b. Stem—flax, jute, hemp, ramie;
      c. Leaf—Sisal hemp, Manila hemp, New Zealand flax;

d. Fruit or nut—cocoanut.

3. Mineral—
   a. Silicates—asbestos.

B. Artificial:
   1. Animal—gelatine rayon;
   2. Vegetable—acetate, nitro, cupra, viscose rayons;
   3. Mineral—fine wires, tinsel, steel wool, slag wool, spun glass.

C. Modified:
   1. Animal—shoddy.
   2. Vegetable—
      a. Natural—mercerized cotton;
      b. Artificial—hollow filament rayon.
   3. Mineral—lacquered wires and tinsels.

TABLE V

MICROSCOPIC APPEARANCE OF STARCHES

Name	Shape	Size	Hilum
Rice	Polygon	Small	None
Corn	Polygon	Small to medium	Stellate in center
Wheat	Circular	Small and large, few medium	None
Tapioca (cassava)	Circular (truncated)	Small to medium	Dot in center
Potato	Small and medium are circular, large are elliptical	All sizes	Dot at end of larger grains
Arrowroot	Elliptical	Under medium to under large	Dot or transverse
Sago	Elliptical (truncated)	Medium to large (stand out boldly)	Dot or transverse

WOOL AND HAIR

The word "hair" is a general term used to describe the coat or covering of mammals and including the more specific terms "bristles", "beard hairs" and "wool". The hair in general is composed of the root, a bulbous portion imbedded in the skin; the shaft, or hair proper; and the tip, or outer end of the hair. The tissues present in a hair are the scales on the outer surface, the epidermis or cuticle layer in which the scales are imbedded, the cortex or fiber layer, making up the main portion of the fiber, and the medulla or pithy center of the hair which is sometimes absent.

Bristles are short stiff hairs with a large medulla forming the coat of certain animals, such as the hog.

Beard hairs are longer, more flexible hairs which have a somewhat smaller medulla. On an animal with both wool and beard hairs, the beard hairs project beyond the wool and form the outside coating.

Wool is the soft, flexible, usually wavy covering of certain animals such as the sheep which have been carefully bred to produce this class of hair. The medulla in the best wools is completely absent and in any true wool is narrow if present at all.

The identification of a fiber as a hair is simple, since the scales are immediate and complete proof of a hair, but the identification of the hair as to its source is rather difficult; and in some cases, where there is an overlap of properties from one animal to another, is impossible. The quantitative measurements of diameter and scale size are of great aid as verifications of qualitative observations as to the shape of scale and the kind of medulla.

Any animal hair may contain "kemps", which are portions of the fiber where the scales are apparently fused together into a horny coating and the shape of the scales can be seen only very indistinctly, if at all. These kempy spots resist dyestuffs and consequently the wool dyes unevenly. The kemps are due to disease or undernourishment.

WOOL

Wool, the hair of the domestic sheep, is generally creamy white in color; 2 to 50 centimeters in length; and 5 to 100 microns in breadth although usually from 13 to 40 microns. The scales vary in shape in the different wools and in some beard hairs are somewhat concave. There are usually, but not always, two scales in the circumference of the fiber. The number of scales per millimeter of length is from 90 to 120. In the finest wools, the medulla is absent, except in beard hairs which are, however, few. The diameter of the hairs has been made the basis of a system of classification which, while promising, is still in the experimental stage. The waviness, or number of bends per unit length, is also of importance—the best grades of wool having the most bends.

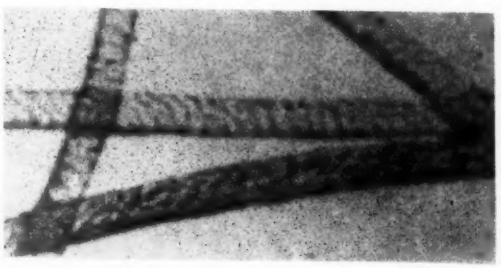


Fig. 47. Wool Fiber (200x)

Coloring matter in the fiber occurs in the medulla and the cortex as fine granules if the coloring is natural; if dyed, the coloring matter is uniformly distributed.

"Lamb's wool" is the first cutting from a sheep and will therefore show natural, tapered ends. Future cuttings will have cut ends at both ends of the fiber.

"Luster wools" from the Leicester sheep is composed

almost entirely of beard hairs 25 to 50 microns broad and with a medulla which is often interrupted. The number of scales per millimeter is from 70 to 90 but usually 80 to 90. In appearance these wools are very similar to mohair, as the scales are laid quite close to the fiber and do not project as do the scales of ordinary wool.

Mohair

Mohair is the hair of the Angora goat and is obtained principally from Asia Minor. The best qualities are creamy white in color, the length is 14 to 27 centimeters,

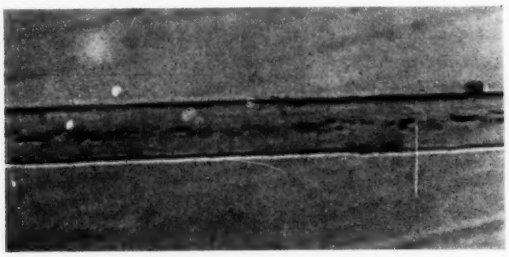


Fig. 48. Mohair Fiber (200x)

and the diameter ranges from 15 to 54 microns but is usually 30 to 44 microns. The scales of mohair do not project from the surface of the fiber as do the scales of wool. The wool hairs have no medulla but usually have

Fig. 49. Kempy Acordin Fibers (200x)

conspicuous clefts in the scales. The scales vary in number from 50 to 60 per millimeter and are characterized by their fine-toothed edges. The beard hairs have distinct medulla.

Camel Hair

Camel hair is naturally of a reddish-brown color and is 6 to 22 centimeters in length. The wool hairs are without medulla and are 16 to 25 microns in diameter; the beard hairs have broad, usually continuous medulla and are 40 to 110 microns broad. The wool hairs have 65 to 90 scales per millimeter and are marked by dark striations which give the hair its color. The scales are diagonal in shape and without teeth.

Minor Hair Fibers

Cashmere, from the cashmere goat, is composed of wool hairs 13 to 20 microns thick and with fine-toothed scales occuring 60 to 70 per millimeter. Clefts are present. The beard hairs have continuous medulla.

Vicuna, from a South American animal of the camel family, contains wool hairs 14 to 18 microns broad, and without medulla; beard hairs 68 to 80 microns broad, with continuous medulla; and an intermediate form 34 to 40 microns broad, with interrupted medulla. The num-

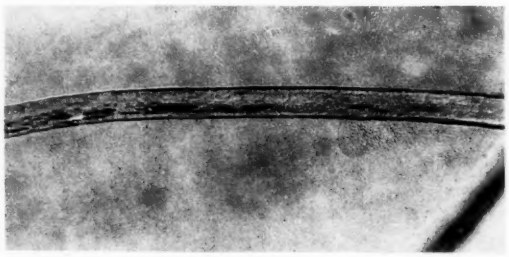
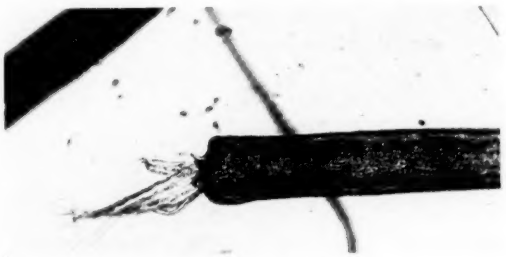


Fig. 50. Camel Hair Fiber (200x)

ber of scales per millimeter is very variable averaging about 80 but sometimes reaching 150. The word vicuna is sometimes used wrongly to designate a mixture of wool and cotton.

Shoddy

In this case, the word shoddy is used to designate all reworked wools whether from unfelted rags, felted rags,



(a) Torn End

(b) Right Bend

Fig. 51. Shoddy Fibers (200x)

or rags containing vegetable fibers. The identification of shoddy depends principally upon the observation of injuries to the fiber, and when these injuries are absent because of mild treatment (as in the case of some unfelted material) the identification of shoddy is difficult and uncertain.

The following characteristics are positive indications of shoddy, but their absence does not mean that the material may not contain shoddy:

a. Fibers with torn ends;
b. Fibers which are rent or torn at the bends;
c. Fibers with bruised spots;
d. Fibers of many colors, either in the original state or after treatment with acids or alkalies;

TABLE VI
MICROSCOPIC APPEARANCE OF ANIMAL HAIRS

	Wool	Mohair	Camel hair
Color	White	White	Reddish-brown
Length in centimeters	2-50	14-27	6-22
Breadth in microns	5-100, usually 13-40	12-54, usually 30-44	16-25 beard hairs 40-110
Scales	Usually 2 in circuit. Shape varies, sometimes concave on the beard hairs	Fine toothed edge. Do not project from surface of fiber	Diagonal, no teeth. Scales on beard hairs thick at edges and have distinct cross walls
Number of scales per millimeter of length	90-120	50-60	65-90
Other characteristics	"Kemps" where the scales are very indistinct	Sometimes longitudinal clefts in surface	Darker striations present

e. The presence of cotton fibers. This is not very conclusive, since a thorough carbonization will remove the cotton.

It should be borne in mind that one or two characteristics are not positive proof of shoddy, but all or nearly all are necessary to be certain of its presence. Care should also be taken in preparing the sample, since the act of tearing out fibers is apt to give broken ends and torn bends; this is especially true in the case of felted goods, where it is almost impossible to get a sample without tearing and breaking fibers.

(To be continued.)

Mildew in Textile Mills

By **HERBERT C. ROBERTS**

Manager Textile Sales, E. F. Houghton Co.

THE yearly toll of bacteria and fungous growths, such as mildew, in the textile mills of this country will probably never be known. Those who have suffered losses due to goods being damaged by mildew and other similar growths seldom mention the fact, as they believe it is a reflection on their executive ability to keep a mill clean. This, however, is not the case. The cleanest mill in the land is liable to damage by mildew when certain conditions, favorable to the growth of mildew spores, present themselves.

In order to understand this matter of favorable conditions and how to prevent the ravages caused by mildew and other fungous growths, it is necessary to know what mildew is and what makes it propagate.

The layman has classified as mildew all those microorganisms of a fungous nature which are known as moulds. They are vegetable organisms closely related to bacteria, but are different from bacteria in their system of reproduction and their life cycles. All types of bacteria have a differentiative appearance, and can be readily recognized under the microscope. While each and every bacterium has its identifying form, nevertheless, they all appear to possess either a bar or rod-shape or a spiral form. The biologist calls the former bacilli and the later cocci.

The fungi group, which includes the moulds and mildews, is on a higher plane of vegetable life than the bacteria. Instead of being rod-like or spiral in their appearance, they are thread-like. They are composed of many filaments which branch out to form delicate lace work, or resemble the branches of a tree. The bacteriologist and other scientific workers have affixed the name hyphae to the class of spots which develop on fruit and textile fibers, which we laymen call mould and mildew.

Just as there are countless bacteria, each of which is capable of producing a different disease in the human body, there are many different mildew hyphae which produce a different colored, and kind of, mildew. Some in-

vestigators claim that they have isolated at least 64 different kinds of mildew. Each kind varies in color and resistance to being destroyed. The resistance to being destroyed is largely dependent upon the method by which the mould or mildew reproduces itself, or grows. The mildew being a higher type of plant life than bacteria, we can expect to find a higher type of reproduction. The bacteria reproduce by cell sub-division, that is to say, one cell divides and forms two cells. These two divide again and make 4. These 4 form 16, and so on by geometric progression.

In some of the moulds and mildews, the whole hypha breaks up and each cell forms the starting point for a new colony. Other forms develop special branches which bear reproductive cells. This is a harder type to kill than the former, as these cells, called spores can remain dormant for a longer period of time.

In the case of the higher types of mildew, we find within the hyphae a special set of cells or spores called, by biologists, sporangia. These cells may be the life cells for reproductive purposes, termed Condiophores or may be a specialized resting cell with resistant walls, which enable the plant to live and survive unfavorable conditions. These may remain dormant indefinitely; and when the textile material has been inoculated with this type of a spore, and encounters favorable conditions, the growth of the mould begins, the mildew is visible, and the damage has been done. The resistant type of spore, that is to say, the one that can remain dormant for a long time, because of its resistant walls, is termed a Chlamydospore.

It is the moulds of the chlamydospore type that cause the most havoc in the textile industry. These moulds are a constant threat as one never knows of their presence until some damage has been caused. Usually, the damage assumes the proportions of a forest fire, a conflagration, before it can be arrested.

For this reason the cleanest and best kept mill is never free from the threat, because incoming material may seem to be free from all visible traces of mildew, yet the spores with their resistant walls are present in the goods, and, when favorable conditions present themselves, the colony springs to life and the goods are ruined beyond redemption. Countless examples of this mildew damage are familiar to everyone. The recent experience of a hosiery mill will explain how uncertain and costly mildew damage may be.

This mill made all their own hosiery tram, the routine being, soaking overnight. In the morning the silk was extracted and dried for a few hours at room temperature. The silk soaked one night was all wound by the following afternoon. The day following the winding saw it all thrown into tram, on bobbins waiting to be backwound the next day upon wooden cones. Up to this point nothing worthy of note was manifest. The backwinding consisted of passing the ends of silk over a roller in a trough filled with a soap-like backwinding solution, upon a wooden cone. This practice has been followed in this mill as well as in other mills and seldom is trouble ever experienced. From the backwinding machines, the wooden cones of silk were placed in a humidifying cabinet, in order to keep the material moist until the knitter was ready to put it upon his machine.

On a certain evening the mill was shut down as usual; nothing was apparently wrong in any department. The following morning all of the silk in the humidifier was covered with patches of mildew. These patches were of different color, in fact no less than 10 different colors were noticed. The question was "Where did it come from?"

Inasmuch as there had been no change in the process or in the materials used in throwing the silk (in fact no new containers of any of the supplies had been opened), the only obvious conclusion that could be drawn was that the mildew was in the silk in a state of arrested development, and in that way came into this mill. It sprang into life under the favorable conditions following the backwinding.

We have mentioned the fact that mildew develops rapidly under favorable conditions. Now let us consider what favorable conditions for mildew growth are, and where they exist in a textile mill. Like all kinds of plant life, mildew must have food, warmth, air and moisture. The foods which nourish mildew and other types of moulds are starches, inorganic salts, and albuminous substances. These are found in practically all textile materials, either as an impurity or as an added substance, such as filled and back-filled goods, silk which has not been boiled off, and woollen goods which have not been completely scoured. A mildew spore can obtain sufficient nourishment from animal fibers themselves, even if the above mentioned items of food are lacking, by reason of the fact that these animal fibers, such as wool and silk, are types of proteins or albuminous substances, and contain food-material suitable for these spores. When this happens it is at the expense of the fibers, because the chemical structure of the fiber is broken down in order to give up the food-material.

The warmth may be supplied by the heat of the mill during the winter months, but this seldom promotes the growth of mildew because the heated air of the mill is usually void of sufficient moisture. This, of course is not true of a hot and steamy dyehouse or where similar conditions prevail. Mildew is most prevalent in the warmer months from June to September, or when the so-called dog days are at hand. During these months the temperature and relative humidity are higher and conditions are more favorable for mildew development than at any other time of the year. In tropical and semi-tropical countries the mildew season (if we can call that time when high temperature and humidity are prevalent, a season), the number of days when goods are liable to become mildewed are more numerous than in cooler countries.

In certain parts of Texas we find material mildewing

and spoiling almost over night at any time of the year, unless preventative measures are taken.

The absence of any one of the four factors which go to make up the favorable conditions will arrest or check the development of mildew and mould. But the absence of these factors will not kill the germ, and, consequently, when the missing factor is supplied, growth and development will take place rapidly.

The only way to prevent the growth of mildew and to be sure that it is not in a dormant state, is to kill the spores present and supply a poison which will kill any new spores which come in contact with the goods. Heat, such as boiling water or live steam, will sterilize or kill any spores present in the goods, whether they be living cells or the cells with special resistant walls. For this reason we see less mildew in colored goods, because the boiling during the dyeing sterilizes or kills the spores in the goods. Then, again, many dyestuffs have antiseptic properties which help to kill the spores. Boiling the goods is not a sure preventive measure, by reason of the fact that some of these mildew fungi might come in contact with the goods at a later time, and, if there is sufficient food, moisture, and heat present, active colonies of mildew will spring up. In order to have assurance that mildew will not develop in textile materials during the processes where the goods are subjected to heat and moisture, that is to say, the optimum conditions for mildew development, it is necessary to add an antiseptic substance to the goods. These antiseptic substances not only kill any spores present in the goods, but will also supply a poison which will kill any new spores which come in contact with the goods in subsequent operations.

Thus, in order positively to prevent mildew in a silk mill, it is necessary to add an antiseptic or a preventive material to the soaking bath, which will stay there until goods have passed beyond the stage where there is food, heat and moisture present. In a throwing mill it means that the preventive agent must remain effective in the silk until the fabric is woven and boiled off. In a hosiery mill it means that it must remain in the silk tram until the stockings have been boiled off and dyed.

In a cotton mill the preventive must remain active until the goods have been woven and sent to the bleachery. These requirements mentioned naturally eliminate the use of many materials which the medical profession classifies as antiseptics. For example, we must eliminate the use of formaldehyde, because this material is volatile, and is driven off even by exposure to the air. Formaldehyde must not be used in a silk mill for a further reason; this being its reaction on the silk gum. Formaldehyde tans and toughens silk gum and other gelatinous substances, rendering them insoluble and difficult to boil off. Again, formaldehyde injures the skin of the operators when it comes in contact with it, and destroys the sense of touch to such an extent that they can no longer handle the silk without breakage.

We can sum up the properties of an ideal mildew preventive and tabulate them as follows:

1. It must not injure the material to which it is applied.
2. It must not interfere with any subsequent processes.
3. It must not evaporate or be driven off under any ordinary conditions.
4. It must be stable and not break down or react with other materials.
5. It must not start any electrolytic action which might corrode or rust metallic parts.
6. It must be free from objectionable odors.
7. It must not be poisonous or injurious to the lives of those handling or using it, as well as the goods.
8. It must be effective when used in small amounts.
9. It must not have a tinctorial power sufficient to discolor the goods.
10. It should not greatly increase the cost of processing the fibers.

This naturally eliminates many substances in certain operations. For example, one could not use zinc chloride or copper sulfate in soaking silk because the zinc and copper salts would combine with the oils to form their respective metallic soaps, and these would stick to the silk and cause trouble in winding, twisting and boiling off. On the other hand, there might be no objection to the use of these salts in preventing mildew in cotton warp sizing, because the kier-boiling would remove them.

Bichloride of mercury is not recommended because of its highly poisonous nature. Furthermore, it is decomposed in the presence of albuminous substances and then is not effective. Thus, it can not be used in soaking silk, by reason of the fact that the silk gum is of an albuminous nature. It can not be used in warp sizing if gums of a pectinous nature are used, for the same reason.

Chlorine compounds must not be considered because the only affective ones are those that contain free chlorine. This is easily driven off and will affect the color of silk and wool.

Salicylic acid can not be considered because of its tinctorial properties in acid solutions and its loss of toxic properties in alkaline or neutral solutions.

Phenol, creosol, napthalene, as well as other similar substances, can be used, provided the odor is not objectionable.

Benzoate compounds are effective, provided the solutions are capable of holding the benzoates in solution. If they are thrown out of solution, the preventive effect is lost.

Certain of the complex fluoride salts, such as those used to make moth proofing agents, are apparently the most effective substances that keep the goods free from mildew under a wide range of circumstances. Very small amounts of these salts are required. They are non-poisonous, do not evaporate, are without odor, do not discolor, and only under extreme cases cause any electrolysis. They can be used in soaking silk, in warp sizing, and any other operation where a mildew precentative is required.

The Dyer's School of Experience

[Editor's Note.—*The following narrative is one of a series being published under the general head of "The Dyer's School of Experience." Realizing that the genuine material for such a series is to be found largely among its own readers, The* Reporter *solicits contributions from that source and will play for those accepted at regular space rates. Among the readers of this journal there should be many who have, in the course of their experience as dyers or chemists, encountered incidents which should prove most interesting and helpful to their fellows. Send all manuscripts to* American Dyestuff Reporter, *440 Fourth Avenue, New York City.*]

Wanted: Some One to Join the Faculty!

By Noel D. White
Davenport Hosiery Mills, Chattanooga, Tenn.

IN MY last episode published in this column, in which I told you how dyeing was carried on in years gone by, I promised to give some more information about Red Nitrosamine which we used in those days with good results, and said it was puzzling to me that it was called "Red" while we used it as a yellow by itself, and as a yellow bottom for dark colors like Green, Olive, and the like.

The reason I did not come out any sooner with it is that I had hoped some other old timer, after reading my experiences of other days, would take the pencil and jot down some of own experiences for the rest of us to read. Surely there must be some quite interesting episodes tucked away in the memory box of the members of the Dyer's fraternity that would make pleasant reading for the rest of us, but it seems that nobody cares to come out and join the faculty of the School of Experience, and I am left to monopolize it all by myself, but I am still hoping.

Learning the Nitrosamine Bad Points

Having learned to use Nitrosamine for dyeing golden shades, it was natural that when having secured a position in a mill where fast colors were their specialty, this dyestuff would be pressed into service. The trade of this mill, however, was principally among woolen mills who used our silk to decorate wool and worsted suiting and dress goods. Not knowing at that time what our colors were subjected to after they left the dye house, I proceeded to dye some samples the manager (also a new man in this place) had handed me to match in the best way known to me. He had told me that we would build up a large clientele if we could dye those shades as fast as they wanted. I felt thoroughly confident, but my assurance got a terrible jolt when some days after delivering the matched samples I was called in the office and handed some yarn that looked as though it had been cut off a floor mop, all discolored in patches, brown, red, yellow, all in a dejected condition, with the remark from the manager that they were my colors after they had gone thru scouring and fulling in the mill of one of his prospective customers. "Our chance in that mill is knocked in the head now", he said as sarcastically as he could.

Well, that knocked me down too. I took those samples back to the dye house and started to investigate. They were those in which the Nitrosamine had been used; a golden yellow; a tan, a golden brown, and a beige. All had a certain percentage of that dye, and all of them had scoured to a dirty reddish brown where they had been exposed to the scouring solution, and in places where they had been knotted to the cloth and prevented absorption of the bath, the original color was still showing and it surely made the rest of the piece look shabby!

This was a condition that had never been known to me. I took a beaker and made up a dilute sulphuric acid bath in it and immersed a part of the discolored yarn, and lo and behold the original color returned as good as before. A trial with a little acetic acid on another piece produced the same results, and then I found out that scouring with a neutral soap the shade would remain about the same, but an addition of caustic or soda ash would change the shade to a dull reddish brown and that was the reason my colors had been returned to me in such a dejected condition, and pronounced unsuitable, only they used a more emphatic adjective. I could have told them that a sour finish would have restored the colors, but it seemed to me like looking for an alibi for my incompetence, so I set about to find a different way of dyeing those shades.

Now I had found the reason why they called that stuff "Red Nitrosamine", it turned red in an alkali bath. It was no good to me anymore in this work, and I never used it again.

Looking for a Substitute

How I was going to find a substitute was my next problem, and not an easy one. In my stock of dyestuffs there was not a single color that could take the place of Nitrosamine. I took my trouble to a friend who had charge of a laboratory for a dyestuff dealer. I told him what had happened; when I mentioned the name of the mill where my samples had been tested, he told me that the personnel of the finishing department of that mill took a hellish delight in making monkeys of anybody that tried to introduce anything new to them. "Only last week I went up there to try to demonstrate a new and much superior black for wool we just got out and they deliberately spoiled a bath to show their boss we had nothing better, and to avoid making a change."

"Well", I said, "there must be something that will replace Nitrosamine. What happened in that mill may happen some other place, and every mill we try to sell our fast colors to is doing scouring and fulling more or less under the same conditions, and I am sure that Nitrosamine is not suitable in our shades now."

"This is easy," he told me, "we have just brought out some new dyestuffs that I believe will do for you. You and I will do some laboratory work now and find what you need."

It must be noted that this occurred during the War, and at the time that one of our largest American Dyestuff concerns was beginning to manufacture dyes on a large scale, and this was taking place in one of their offices.

Before going home that night we had worked out, to our mutual satisfaction, formulae for all the shades we needed, and I gathered a store of information for future endeavor. I, also, brought home with me dyestuffs enough to go to work the next morning on some lots that were on order, and could not dye until the proper dyestuffs had been found, but when I started work that morning it was with a song in my heart and happy in the thought that once again I was going to show them, in spite of the war and the shortage of dyestuffs.

A New Line of Fast Colors

The first shade we tackled was the Tan. We decided that a chrome dye or two would do for that shade. After consulting a sample card, we picked out Erie Orange Y and Erie Brown G B, and got with them just the shade needed with the following formula which worked fine:

Erie Orange Y 3 per cent
Erie Brown G B 3 per cent
30 pounds Glauber's Salt
3 pounds Acetic Acid

Starting at 110°F., we raised the temperature 25 degrees every five turns for twenty turns, then washed and after-treated with 2 per cent Bichromate of Potash, 2 per cent Blue Stone, 2 per cent Acetic Acid at 180°F. for one hour.

That was a knock-out. They could scour and full that shade with all the alkali they wanted, and if it did not ruin their cloth that Tan would not show the least change.

Learning the Behavior of Some Dyestuffs

The Golden Brown came next, and for this I got introduced to a yellow that is invaluable even today, provided its idiosyncrasy is understood, Erie Yellow K M. My friend told me at the start it would be well to watch how it worked, and take notes of the changes it underwent in processing. "Dyers get in trouble with this Yellow and don't want to use it, but it is all right when you know how it works", he told me.

After a few trials, we finally got what we wanted

3 per cent Erie Yellow K M
2 per cent Erie Orange Y
½ per cent Erie Brown G B

dyed and after-treated as the above.

If I had to work out those shades with the mentioned dyestuff by myself, it is very doubtful that I would have adopted them. What has been said of Erie Yellow K M applies, also, to Erie Brown G B; their true color does not show up until the chrome after-treatment. In the dye bath with the correct amount of those two dyes the shade appeared several tones darker, and it is natural that the dyer gets worried unless he is acquainted with the change that takes place in chroming it. It is in this bath that the shade is cleared up, and when the right proportion of dyestuffs is found, shades dyed with them can be depended upon to work always the same. To make sure that the same shades were obtained for repeat order, we cut off a piece of a skein after the dyeing to match the lot as it looked before chroming, but we soon found that if we made no mistakes and did not weigh hundredweight instead of pounds, or pounds instead of ounces, a little overweight or underweight did not make much difference in the finished product.

Learning to Use Primuline

Then we started on the Golden Yellow, and the Biege, and learned a few more tricks that were quite interesting. My demonstrator suggested those two shades could be dyed with Primuline. The dyestuff was not new to me, but I had learned to dye with it and to develop yellow with Phenol, Orange with Resorcine, and Red with Beta Naphthol, quite proficiently, but I could not see how we could use it in developing the shade of Golden Yellow and particularly the Beige. However, I was willing to be shown.

We dyed a sample in 8 per cent of Primuline in a Glaubers Salt bath with 3 per cent Acetic Acid, then we diazotized it in the usual manner; 3 per cent Nitrite of Soda, and 5 per cent Sulphuric Acid, and got the well known brownish yellow, then instead of developing the shade in a regular developer, we washed it and then put the yarn in a soap bath at 160°F. and presto! the brownish yellow turned into very near the shade of Golden Yellow we had to match. At this point my friend pointed out the fact that if instead of fresh soap we had used a bast or silk gum soap we could now break it with Acetic Acid, and use that yellow bottom for any shade we desired. The soap had served as a developer for a shade, and could now be used as a bath to match the yarn to pattern. Very simple, but how is anybody to know that Primuline could be made to perform such acrobatic stunts when it was advertised mostly for dyeing Red and sometimes for Yellow and Orange with suitable developers?

After seeing this, I had no more doubts but the Beige could also be done in the same way. Yet I had to learn something more. My chemist friend was showing me something worth while.

The Beige did not require such a deep Yellow bottom, but it needed some toning, and to my surprise he did the toning right in the Primuline bath. We had to make several attempts to get the shade needed, but finally got it near enough so that I was sure I could finish it satisfactorily.

My correct formula was finally made up as follows:

Beige: (for 100 pounds)

Primuline	1 pound
Erie Fast Brown 3RB	¾ ozs.
Developed Black	8 grams
Acetic Acid	3 %

in a Glaubers Salt bath.

Start at 120°F., every five turns raise heat 25 degrees. After twenty turns, wash. Diazotize and Soap at 160°F.,

shade in soap broken with Acetic Acid with Benzo Black and Archil if needed.

This dyeing seems absurd now even to me at this writing, but when I dyed my first lots at the time, and took a piece of each skein to be sent on approval, I had no fear as to the outcome of the customer's tests. The results were quite gratifying for we got the customers and the orders, but my troubles were not yet over. The formulae were not by any means correct; every lot had to be shaded to tone it down or up to pattern. The figures on the formulae had to be juggled every time a new lot was dyed, the aim being to get the shade correct without having to add dyestuffs at the finish, which could not be as fast as the body of the shade, and also to save time.

A New Slant on Developing Colors

Having acquired a new technique on dyeing with Primuline, my earnest endeavors now were turned to make up my formulae so that a given shade would come out correct without additional toning in finishing. Every time that shade was dyed a new formula was made up with a slight change in the proportions. In the beginning, the change was made in the proportion of dyestuffs used in the bath, then we started on a new slant—mixing the developers. Only certain developers were found suitable for mixing one with the other. Resorcine, Beta Naphthol, and Metatoluylene, or Metaphenylene—diamine. Here again we had to learn that the mixing had to be done with caution, or one would destroy the effect of the other.

For instance, if we mixed equal parts of Metatoluylene diamine and Resorcine, or Beta Naphthol, the last named would be overcome by the more powerful Metatoluylene and failed to show up. To produce a darker, redder shade of Orange, 1 per cent Resorcine combined with four to five ounces of Beta Naphthol would be very effective, and for a darker shade of Red, 1 per cent Beta Naphthol with three to five ounces of Metatoluylene-diamine would produce the desired effect.

Turning Failure into Success

We were now able to satisfy our customers with all the shades wanted, and a very large clientele was built up. Every season a new list of shades was sent in; we first dyed one skein for their tentative patterns for the new styles, then we dyed from three to ten pounds of the selected shades for the manufacturers' samples, and after that the orders would come in for twenty-five to hundred pound lots.

We had become so proficient with this work that the mill could not spin silk enough to supply the demand in season, and had to buy yarn outside to fill our customers orders for dyed yarn. We had a line of Reds from Scarlet to Dark Maroon, all dyed with Primuline; some toned in the bath, and developed with Beta Naphthol, others with straight Primuline and developed with both Beta Naphthol and Metatoluylene diamine, still others with toning in the bath and mixed developers. For a (hundred pounds) *Clear Bright Red*: 8 per cent Primuline, 30 pounds Glauber's Salt, 3 per cent Acetic Acid, in 20 turns. raising slowly to boil and rinse. Diazotize with 3 per cent Nitrite of Soda, 5 per cent Sulphuric Acid in cold water for 30 minutes, and rinse. Developed with 2 per cent Beta Naphthol, boiled with 1 per cent Caustic Soda, in a cold bath for 30 minutes, and rinse. Soap at 140°F. with 3 per cent Soap and finish. For a *Cardinal Red*: use the same formula, and make up the developing bath with: 2½ per cent Beta Naphthol, and 5 ozs. Metatoluylene-diamine. For a *Dark Maroon*: 10 per cent Primuline, 1½ per cent Erie Fast Brown 3 R B, 1 per cent Diaminogene Extra. Diazotized as above. Developed with 2½ per cent Beta Naphthol and 4 ozs. Metatoluylene-diamine boiled with 1½ per cent Caustic Soda, Soap at 140°F. or higher for a brighter shade.

Several shades of Yellows and Oranges could be produced in the same manner by changing the developers or soaping after the diazotization. One of the shades that gave us the most trouble was a dark Burnt Orange. A very good and popular shade that we struggled with for months before we could produce direct without having to tone it to pattern.

We kept changing dyeing formulas, and mixing of the developers, but never could get it just right. We never gave up, though. Every time we dyed it we made the changes deemed necessary to make that blooming Burnt Orange without having to correct it. It got to be a nightmare, we turned somersaults, and handsprings all around that formula for a long long time, but finally one day we just hit the bull's eye. When we did we never had any more trouble with it; that formula was fool-proof. We have no further use for it so here it is for any who may need it:

Burnt Orange (for 100 pounds):

Primuline	7½ pounds
Erie Fast Brown 3 RB.....	1 ounce

in a Glaubers Salt bath, Glaubers Salt 30 pounds, Acetic Acid 5 per cent in 20 turns as explained above. Diazotized with 4 pounds Nitrite of Soda, 5 pounds Sulphuric Acid, and wash goods until all sulphur odor disappears, or in the developing bath the shade is apt to come out uneven.

Developed cold with Resorcine developer 14 ounces, Beta Naphthol 5 ounces, boiled together with 16 ounces of Caustic Soda for thirty minutes, rinse. Soap at 140°F., and finish.

It looks very simple, now—but it surely gave us a run to reach it. When we finally got that recalcitrant shade whipped into line we celebrated. Nothing ever gave me so much satisfaction as after so many heart-breaks and disappointments to have conquered it. I suspect that is the same thrill as proved by an engineer or a master builder in looking over the accomplished fact of a finished bridge, or a sky-scraper. Fighting a shade is as much a battle in the day's work of a dyer as in any other struggle, and the final accomplishment gives as much satisfaction as in any other line of endeavor.

F. U. Rapp has recently been chosen by the Hercules Powder Company to devote his entire time to pine oil sales development work.

AMERICAN DYESTUFF REPORTER

SAMPLE SWATCH QUARTERLY

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

WILLIAM HOWES COLLINS
Managing Editor

MYRON DREW REESER
Advertising Manager

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JULY 7, 1930

ACTIVITIES OF THE MELLON INSTITUTE

IT might be interesting to enquire just how much the average chemist, dyer or manufacturer knows about the purpose and scope of the Mellon Institute; whether he realizes the worth of keeping in touch with its activities. The Institute is primarily an industrial research organization, but one of its fundamental policies is the furtherance of education in the methods and results of scientific investigations. It is constantly training qualified young men for research or technical posts in specific fields of technology. Many contributions to scientific literature are made each year by fellows in its department of research. By means of lectures, radio talks, publication of articles and distribution of reprints the Institute is able to foster a greater appreciation of research—in itself, an educational policy of importance.

Too frequently the Mellon Institute is regarded by the layman as a large scale consulting laboratory or as an elaborate system of fellowships enabling young men to obtain postgraduate training. Both of these are in a sense, true. Industrial problems are investigated, but only when they promise to involve important scientific principles and require a long period for study. No courses of instruction are offered by the Institute, however, through a co-operative arrangement with the University of Pittsburgh the men are given the opportunity to pursue their postgraduate work under its auspices. It may be seen from this that the Institute does not in any way compete with the practising consultants or commercial laboratories; rather it carries along lines which would be impractical for the ordinary business. The paramount functions of the Institute are the betterment of manufacturing practice and the advancement of both pure and applied science. These are made possible by self-supporting industrial fellowships which conduct research for associations of manufacturers as well as for individual companies.

A WORD ON COLOR

WITH the advent of present-day prosperity and higher standards of living, there have been notable changes in the buying habits of American consumers. As a result, many manufacturers have found it not only necessary but imperative to readjust their sales policies and machinery for the purpose of stimulating sales. Such a readjustment of merchandising systems has been very largely brought about by increased style penetration. This increased style penetration means that the consuming public has become more acutely style conscious; no longer is it willing to accept anything which cannot be properly classed as the mode.

Under the old system of manufacturing and marketing, the producer could work on a regularized production basis, leaving his goods stored awaiting sale. But that was before the world knew such universal schooling, rapid transportation, movies and radio—all factors in the increased penetration of style enabling certain sections to know how others are living.

The upheaval of all the old traditional methods of marketing defined the entrance of a new era, one in which style stands paramount. Style is a broad term; in general, if there is demand for a commodity it is stylish. Style embraces many factors of which color is one of the most important.

Two representative industries having style problems, especially style color problems, are the dyeing and the printing branches of the trade. The dyehouse of a mill cannot keep using the same colors or shades continually. The styles in color change, and to be really successful, the dyehouse must not follow others blindly but rather it must anticipate the demand for different colors or color effects. The printer has similar problems as far as colors are concerned, but his goods are also influenced to a large extent by style changes; that is, the design pattern may be large, small, flowered, or Colonial.

Keeping one jump ahead of style is a problem in style research. This implies searching again into styles that have passed. It is pointed out by research that styles go in very definite cycles. First is the cycle by days; in the morning one dons a certain type of clothing, in the afternoon one adapted to sports, in the evening dinner clothes, and upon retiring still another garb. All of these indicate the trend of color for different times of day. Another cycle is shown in the home, the color scheme in the various rooms bearing a very definite relation to the time of day when the room is used. For example, in the breakfast room are found bright, cheerful colors—in the library, warmer and more restful tones. A third cycle is discovered in the home as related to the seasons. In Winter, warm colors predominate; in Summer, light, cool colors receive emphasis. The same cycle may be equally well applied to clothing. The longest of all are the ten, twenty, and forty year cycles. It has frequently been observed that

after a period of years styles tend to repeat. This would indicate that a color or color combination which enjoyed great popularity some time ago will, at some future time, again become the vogue.

It is a duty of style research specialists to collect this data, study it, and then to forecast, if possible, just how the trend of style or color will probably move. It has been said that every time a new color appears one may, provide he is endowed with sufficient patience, trace it back to discover that it had either a direct or an indirect Oriental origin. Successful style, design, or color is always based on tradition. Frequently the assertion is made that modern methods have yet to produce colors as beautiful as those of India, Egypt or Peru; but that is a problem for research on the part of the dyer himself and not that of the dyestuff manufacturer. It may be seen that style research should be an inherent policy in all modern marketing methods. It is quite evident that any dyehouse or print works might well afford to pay a great deal of attention to this problem if it wishes to keep up with, or ahead of, the rest of the industry.

No matter where one looks, he notices that color predominates in most marketing systems. The style trend recently has been for ensemble sets. The stylist in the mill should bear this in mind, for the mill cannot expect to sell goods that do not harmonize with the surroundings in which they are to be used. A kitchen painted in a certain color, for instance, has a stove, sink, linoleum and curtains of the same tone, and the bathroom, too, has departed from its traditional white and may now be seen in any one of a number of color combinations.

Every other art, science, and form of education recognizes that the traditions of the past are connected with the facts of the present. If the man of to-day could visualize in perspective thousands of years and see how among various races of peoples color has played a vital part in all forms of commodity exchange, he would attack this problem with deeper respect and also would appreciate the more the age which lies ahead, the most colorful and beautiful of all time.

Random Thoughts On Research

Who Benefits by Textile Research?

THINK it over a bit or you may not get the right answer, because there are quite a few different ways of looking at this question. There are immediate benefits and ultimate benefits. The first one to benefit is the man who does the work and gets paid for it, the research director and employee. The one who gets the ultimate benefit is the one who buys and uses or wears the textile material.

Where does the textile man come in and what does he get for the money that he puts into it? The wise textile man can squeeze in between and make a profit on some of the results of the research, and as for spending his money, it is only the most elementary economics that he will pass the cost along with his other manufacturing and sales costs to the ultimate consumer.

On the day that he is solicited for research support, he may not be able to see at all how he will ever get it back, but we proponents of research should try to think it out and be able to answer questions. Some other line of argument may have more appeal at the time but his success actually hinges on the fact that the consumer pays.

It should be clear that it is not easy to show a manufacturer just how he is going to benefit from research that is available to everybody else. Here is one reason that must not be overlooked. In spite of a great deal of valuable scientific work that is done in this country on textiles, we have the reputation of not doing as much as some foreign countries, particularly England and Germany.

These countries, which are well started on large research programs are supposed thereby to obtain eventually advantages over us which will be greatly in their favor in competition in foreign markets where there is no tariff to favor us, and even here at home.

A high tariff may be a justifiable expedient to maintain domestic prosperity, but it is certainly not the best permanent basis for future success. It is far more sound to trust some part of future prosperity to science than too much to the uncertainties of politics.

The textile manufacturer is probably not enthusiastic about discovering new things that will cause the scrapping of large investments in machinery, buildings or processes, some of which may not yet be anywhere nearly written off; or in otherwise disturbing the even tenor of his ways. Can you blame him when the "even tenor" is now perhaps a wild scramble to keep up with novelties and fashions?

Here again there is another side. The textile interests should explore the possibilities of their industry and know it thoroughly. New things and new ideas can easily come in from outside, with undesirable competition. We mentioned rayon, which has worked out favorably on the average. Another instance is coated fabric with its many ramifications developed largely outside as a chemical industry. Here a cheap cloth by proper treatment has found many new uses; it has also doubtless in many cases replaced a much higher grade of finished cloth.

In these days almost anything else can happen. What is being done to prevent the all-metal plane driving out cotton and linen as airplane fabrics? Community research on certain problems can do much to eliminate drudgery, and particularly disagreeable jobs. For example, dyehouses often have a serious labor problem, where cost and turnover might both be greatly improved.

Research may also, by lowering the costs of textiles, aid in the competition for the consumer's famous dollar. Whether this is true or not, the money invested in research can be recovered, because just as in developing autos, radios or electric refrigerators the extra costs may be carried by the trade for a time but will eventually be distributed in exchange for part of that consumer's dollar.

Dyers' Accounts, IV

The Sales Ledger—Ascertaining Gross Profits—Presenting a Balance Sheet

By S. HOWARD WITHEY, F.C.I.

AS EVERY item recorded on the left-hand or debit side of one book or account will have a corresponding entry on the right-hand or credit side of another book or account, and *vice versa, it* follows that the clerical accuracy of the book-keeping work performed during the dyer's accounting period can be verified by making out a list showing the totals of the debits and credits in the complete set of books. If no errors have been made in any of the postings or additions, the total of the debit items will exactly agree with the total of the credit items.

In practice, however, instead of ascertaining the total debits and credits, it is found more useful to prepare a list of ledger balances outstanding at the date of stock-taking. Providing no errors have crept into the accounts, the total of the debit balances will correspond with the total of the credit balances, and the summary of balances will constitute a very convenient foundation on which to construct the periodical trading account showing the amount of gross profit made; the profit and loss account showing the amount of net profit realized, or the extent of the loss sustained; and the balance sheet or statement of affairs exhibiting a true and correct view of the dyer's financial position on a given date.

The Trial Balance

The summary of ledger balances, or the trial balance as it is usually called, should be made out on a sheet of paper which has been provided with two money columns, the debit balances being shown in one column, and the credit balances in the other. The balance of cash-in-hand as shown in the dyer's cash book at the balancing date should agree with the actual contents of the till, or cash box, and this amount will have to be set down as a debit item in the summary—the cash book being really nothing more than a separately bound cash account. The bank balance will be either a debit item or a credit item, however, according to whether it represents a sum standing to the credit of the dyer, or an overdraft, and although the correct figure to set down in the trial balance is the difference between the bank columns of the cash book, the amount should be reconciled with the balance shown in the bank pass book by ascertaining the total of the cheques which had not been presented at the bank for payment on the last day of the period.

It is not necessary to set down on the trial balance the various debit balances owing by customers and debtors, or the different credit balances due to manufacturers and suppliers. A separate list of sales ledger balances and a list of purchases ledger balances should be prepared, the total of the former being recorded in the debit column of the summary, and the total of the latter in the credit column. The balance of each account kept in the nominal or expenses ledger, and in the private or general ledger, will have to be shown as a separate item, and when all the balances have been extracted the totals of the two columns should correspond with each other. If the totals fail to agree, the disagreement will be the result of one or more of the following:

(a) An amount recorded in one of the books of original entry—such as the cash book, day book, bought journal, etc.—has not been posted to its respective account in the ledger.

(b) An item entered in a subsidiary book has been posted to the ledger more than once.

(c) An amount has been posted from one of the prime books to the wrong side of the particular ledger account.

(d) A ledger balance has been incorrectly set down or omitted altogether.

(e) A subsidiary book, or a ledger account has been incorrectly added up.

Errors Not Easily Revealed

A good system of organization will reduce the number of errors and irregularities to a minimum, and where possible it is always advisable to arrange matters so that each clerical operation is conducted by one person in the first place, and afterwards automatically checked by another person. It should never be forgotten that although the totals of the debit and credit balances shown in the

summary may readily agree with each other, there are certain errors which, owing to their peculiar nature, would not be revealed in this way, as for example:

(*a*) If an amount recorded in the dyer's day book has been posted to the debit side of the wrong personal account in the sales ledger, the trial balance would be unaffected, the total of the amounts owing by customers and debtors as shown in the books being the same.

(*b*) If an amount has been incorrectly entered in the subsidiary book, the mistake would not come to light by the preparation of a summary of ledger balances, providing the amount has been posted as originally recorded.

(*c*) If an error made on the debit side of one ledger account is off-set by an error or errors of a corresponding amount on the credit side of another ledger account, the fact would not be disclosed on the trial balance.

The speedy localization and detection of clerical errors depends to a large extent on keeping the various ledgers on what is called the self-balancing principle, enabling each ledger to be balanced quite independently of the other

---

SALES LEDGER

	£ s. d.	£ s. d.
Total of debit balances outstanding at the commencement of the year or period, after deducting the total of any credit balances shown in this ledger		150 16 3
Total of the items entered in the sales books or day book during the entire year or period and posted to the debit side of accounts kept in this ledger		2,175 14 2
		£2,326 10 5
Total cash received from customers and debtors during the period, as recorded on the debit side of the general cash book, or in the cash received book, as the case may be, and posted to the credit side of the various accounts	1,621 14 6	
Total discounts allowed to credit customers in respect of prompt payment, as shown in the discount column on the debit side of the cash book, and posted to the credit side of the ledger accounts	26 15 9	
Total value of returns inwards, including allowances made in lieu thereof, as detailed in the sales credit book, or at the end of the sales book	185 11 3	
Bad debts written off to bad debts account	12 10 7	
Total transfers to other ledgers	265 0 0	
		2,111 12 1
Total debit balances outstanding at end of period (as per list of balances)		£214 18 4

PURCHASES LEDGER

	£ s. d.	£ s. d.
Total of credit balances outstanding at the commencement of the period, after deducting the total of any debit balances shown in this ledger		362 19 1
Total of the items recorded in the purchases book or bought journal during the entire period, and posted to the credit side of accounts kept in this ledger		1,215 7 6
		£1,578 6 7
Total cash paid to suppliers and creditors during the period, as recorded on the credit side of the general cash book, or in the cash payments book, as the case may be, and posted to the debit side of the various accounts	973 14 2	
Total discounts obtained from suppliers in respect of prompt payment, as shown in the discount column on the credit side of the cash book, and posted to the debit side of the ledger accounts	31 7 2	
Total value of returns outwards and allowances, as detailed in the purchases credit book, or at the end of the purchases book, and debited to the personal accounts	129 16 5	
Transfers to other ledgers	25 10 0	
		1,160 7 9
Total credit balances outstanding at end of period (as per list of balances)		£417 18 10

ledgers. The summaries of the accompanying sales ledger will serve to indicate the practical method of marshalling the various figures for the purpose of proving the accuracy of the dyer's sales ledger and purchases ledger.

* * *

Having verified the clerical accuracy of the bookkeeping records, and assessed the value of the stock of dyestuffs, chemicals and so forth, and work in progress, it will be possible for the dyer to ascertain the amount of gross profit which has been realized during his accounting period by preparing what is usually referred to as the trading account.

The trading account will have its debit and its credit side, and the first amount to be set down is the value of the stock on hand at the commencement of the period under review, this figure corresponding with that shown on the trial balance, or summary of balances, and also with the amount shown on the assets side of the previous balance sheet. The next item to be set down on the debit side of the account will represent the value of the dyer's purchases during the entire period, after deducting the value of all returns outwards including allowances made by suppliers in lieu of actual returns. If the carriage and cartage expenses have been analyzed under carriage and cartage inwards, and carriage and cartage outwards, the inwards total should be shown on the debit side of the trading account as a separate item, the cost of the periodical purchases having been increased by this amount, but if, as is more likely, only one carriage and cartage account has been kept, the total expenses under this heading should be treated as a profit and loss account item.

On the credit side of the trading account should be shown the value of the sales, both cash and credit sales, including all charges made by the dyer during the period for work performed, after deducting the value of all returns inwards and allowances made to customers in lieu of actual returns, and also the value of the stock on hand and work in progress at the balancing date, assessed at cost or under. When these items have been set down, the amount by which the total of the credit side of the account exceeds the debit total will represent the amount of gross profit made, as indicated in the accompanying specimen account.

To enable comparisons with the results of previous years or periods to be easily made, it is a good plan to work out the percentage which each item in the trading account is of the total net sales, these percentages being set down in red ink in an inner column ruled on each side. These percentages will reveal any excesses, and will enable the dyer to form an opinion as to whether too much or too little stock stock is being carried.

Preparing the Profit and Loss Account

To ascertain the amount of net profit realized during any financial period, or the extent of the loss sustained, it will be necessary to prepare a profit and loss account showing, on the debit side, the various management and working expenses and business charges, and on the credit side the balance of the periodical trading account representing the amount of gross profit, together with any other gains or income.

TRADING ACCOUNT
YEAR ENDED MARCH 31, 1930

Dr.

To value of stock as at March 31, 1929....	£	:	:
" Purchases. Less returns and allowances		:	:
" Balance, being gross profit transferred to periodical profit and loss account.....		:	:
	£	:	:

Cr.

By Sales. Less returns and allowances....	£	:	:
" Value of stock as at March 31, 1930...		:	:
	£	:	:

The expenses should be grouped under suitable headings and before transferring the balances of the different nominal accounts it is absolutely essential that adequate reserves should be made for all expenses which have accrued at the date of stock-taking, including any proportions due to over-lapping. For example, if the dyer is accustomed to pay the monthly salaries of the clerical staff at the beginning of the following month, he would have to reserve a full month's salary when preparing his final accounts, otherwise the amount transferred from the salaries account to the profit and loss account would not be the full and proper charge under this heading. The amount to be reserved should therefore be entered as the last item on the debit side of the salaries account, giving the balancing date and the words "To Reserve carried down," after which the balance of the account may be transferred, and the reserve brought down on the credit side as the opening entry for the next year or period, reading—"By Reserve brought down." The amount entered on the credit side of the cash book, representing the salaries paid for the last month, would be posted to the debit side of the salaries account in the usual way, and would off-set the reserve shown on the credit side.

When all accrued expenses have been passed through the books, attention should be directed to any payments which have been made by the dyer in advance, and which actually cover a period extending beyond the balancing date. For instance, insurance premiums paid during the period under review will most likely remain unexpired when the final figures are tabulated, consequently in order to insure that the profits for the period are not unduly burdened with charges that should be debited to another accounting period, the proportion of the premium which has not expired at the date of stock-taking should be ascertained, and the amount entered as a reserve on the credit side of the insurance account before transferring the balance to profit and loss, the reserve being also brought down as the opening entry on the debit side of the account.

As soon as all reserves have been dealt with in this way, the balances of the different nominal accounts may be summarized to constitute the profit and loss account, a good method of presenting the figures being as under:

PROFIT AND LOSS ACCOUNT
YEAR ENDED MARCH 31, 1930

Dr.			
To Wages and Salaries	£	:	:
" Rates and Taxes		:	:
" Gas, Water and Lighting		:	.
" Carriage and Cartage		:	:
" Repairs and Renewals		:	:
" Depreciation		:	:
" Bad and Doubtful Debts		:	:
" Stamps and Postages		:	:
" Bank Interest		:	:
" Agents' Commissions		:	:
" Advertising and Insurance		:	:
" Sundry Trade Expenses		:	:
" Balance, being Net Profit for the Year		:	:
	£	:	:
Cr.			
By Gross Profit, transferred from Trading Account	£	:	:
" Rents Received		:	:
" Dividends Received		:	:
" Discounts		:	:
	£	:	:

When drafting the balance sheet, the total of the accrued expenses must be shown as a liability, while the total of the unexpired insurances, payments made in advance, etc., should be included on the assets side.

* * *

The items remaining on the trial balance after the periodical trading and profit and loss account has been prepared represent the book value of the various assets which are employed in the business for profit-earning purposes, and the amount of the different liabilities, the former being debit balances, and the latter credit balances. These items have to be summarized in the form of a balance sheet which should exhibit a true and correct view of the state of affairs on a given date.

Although there is no standard or uniform method of presenting a balance sheet, the assets of the dyeing concern are usually enumerated in the order of their convertibility, that is to say, with reference to the readiness with which they could be converted into actual cash, if such a course was found to be necessary or desirable. The following list shows the correct order of convertibility:

CASH ITEMS

Cash in hand, corresponding with the debit balance of the "cash" columns of the general cash book, and with the actual contents of the cash box, etc.

Cash at bank, corresponding with the debit balance of the "bank" columns of the cash book, and with the pass book balance, subject to cheques paid away by the dyer and not yet presented at the bank for payment by the payees.

Cash which has been advanced by the dyer, and which is returnable on demand or at very short notice.

Securities and investments of a gilt-edged nature.

Any other assets which could be turned into cash almost at once.

Bills receivable, being the total value of bills of exchange which have been drawn by the dyer, accepted by the debtors, but not yet met.

Book debts, consisting of amounts owing by customers and debtors, and representing the total debit balances of the personal accounts kept in the sales' or customers' ledger.

Shares held by the dyer.

Stock on hand, including the value of the work in progress.

Any other assets which could be realized at short notice.

Transport means used for business purposes, including vans, cycle-cars, and so on.

Machinery and plant.

Business premises, including freehold and leasehold land.

Tools, implements and appliances.

Shares held by the dyer for the purpose of securing business as distinct from investments.

Furniture, fixtures and fittings.

Any assets which are unrealizable except with the business as a going concern.

The book value of the business's goodwill.

Any amounts which have been capitalized by the dyer for the time being, but which will eventually have to be charged against the profits.

Losses in other directions.

The best order for the liabilities is: (*a*) Bank overdraft; (*b*) bills payable; (*c*) trade creditors; (*d*) accrued expenses; (*e*) loans; (*f*) reserves; (*g*) capital of the dyer, or the separate capitals of the partners.

In the case of the business which has already been converted into a limited liability company, the liabilities and the assets should be shown on the balance sheet in the following order, where applicable:

LIABILITIES

Nominal or Authorized Capital.
Issued or Paid-up Capital.
Debentures.
Mortgages.
Amount Due to Bankers.
Bills Payable.
Creditors.
Reserves, etc.
Balance of Profit and Loss.

ASSETS

Business Premises, including Land.
Furniture, Fixtures and Fittings.
Machinery and Plant.
Tools, Implements and Appliances.
Motor or other Transport Means.
Stock, including incompleted contracts.
Material on Consignment.
Book Debts.
Bills Receivable.
Cash at Bank.
Cash in Hand, including Petty Cash.
Investments.
Goodwill
Preliminary Expenses.

Calculating Depreciation

Each wasting asset employed should be subjected to an adequate deduction to cover depreciation resulting from constant use, actual obsolescence, or the lapse of time, and in this connection there are four principal methods of determining the depreciation, each method having its own peculiar advantages when applied in specific instances. They are as under:

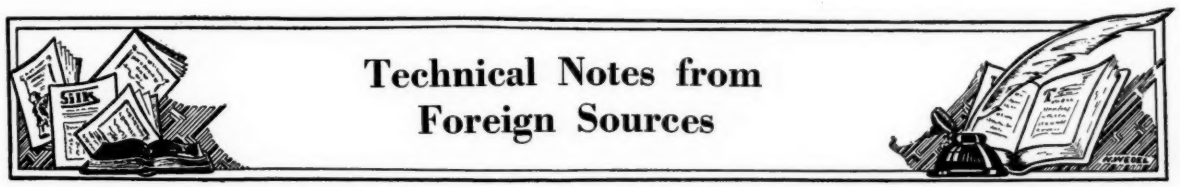
Method No. 1.—An equal proportion of the first or original cost of the asset may be written off each year, so that at the end of a definite period, estimated to represent the effective life of the asset as a profit-earning factor, the book value will automatically be reduced to nil.

Method No. 2.—A fixed percentage of the first or original cost of the asset may be written off the gradually diminishing book value of the asset, so that at the end of a certain period the debit balance of the asset account will represent a purely nominal or break-up value.

Method No. 3.—The debit balance shown in the asset account at the commencement of each financial year or accounting period may be increased by the addition of interest at a definite rate per cent per annum, and the cost of the asset (including interest) spread evenly over a certain period.

Method No. 4.—The asset may be subjected to a revaluation by an acknowledged expert, and the ascertained shrinkage in value charged against the periodical profits in one amount.

Whichever method is adopted, the amount representing the depreciation should be recorded on the credit side of the particular asset account, and also on the debit side of a depreciation account, the final balance of the latter being transferred to profit and loss, and when drafting the balance sheet the sums written off should be shown as deductions from the different assets as enumerated on the assets side.—*The Dyer & Calico Printer.*



Technical Notes from Foreign Sources

Detection of Damage by Bleaching

Dr. Erich Baur — Textil-Chem. u. Colorist 10,153 (1929).—Oxy-cellulose, so called, formed by the vigorous action of bleaching-agents upon cellulose, becomes evident in over-bleached cotton goods by their turning yellow, the result of the action of alkali upon the oxy-cellulose. This is a plainly-visible evidence of its presence; its existence is further characterized by its reducing alkaline solutions of copper, silver or mercury salts. Solutions of the first two of these metallic salts are suited for the quantitative determination of oxy-cellulose. For the correct interpretation of results with these reagents, it it a prerequisite that the goods be free from finishes which contain dextrose or starch, as well as from natural impurities, as pectin, since these substances also exert a reducing action.

In such a determination, the copper solution long used for the purpose is the familiar Fehling's solution, an alkaline solution of copper sulphate and potassium sodium tartrate (Rochelle salt). On boiling a swatch of over-bleached cotton goods with this solution, red cuprous oxide separates out upon the fiber. The amount of cuprous oxide is dependent upon the degree to which the cellulose has been attacked, and furnishes a clear indication of the location of the damaged area, if the damage is not evenly general. For quantitative purposes, the cuprous oxide is dissolved from the swatch, and the copper determined electrolytically or otherwise. The copper number, according to Schwalbe, indicates how many grams of copper have been separated by 100 grams of the goods. Braidy's method is perhaps the best; he proposes the use of a mixture of sodium carbonate and bicarbonate in place of the sodium potassium tartrate generally used.

In this connection, the permanganate number of Kauffmann ought to be mentioned. To determine this value, the goods are wetted out with caustic soda, the dissolved oxy-cellulose is titrated with N/10 permanganate, and the amount of permanganate used determined by titration. The boiling-off must be repeated until two successive boilings-out give the same value, which is taken as the fundamental value. The sum of the separate results, minus the fundamental value, gives the permanganate number. In practical work, the first and second boilings-out are usually sufficiently significant.

Alkaline solutions of silver salts act more rapidly than does Fehling's solution. They are prepared by precipitation of silver oxide from silver nitrate solution by means of excess of caustic soda, and re-solution of the pre-

cipitate with ammonia-water or sodium thiosulphate in reasonable excess. Even in the cold, particularly on warming to 40°-50°, black or brown metallic silver separates out upon the damaged spots. Normally bleached, oxy-cellulose-free cotton also reduces the silver reagent, if heated with it too long or at too high a temperature, or if an insufficient amount of ammonia or thiosulphate is employed. Should viscose be tested with the silver reagent, it must be remembered that traces of sulphur are often present, originating in the method of manufacture of the fiber. Silver solutions, of course, are specially sensitive to sulphur, and spots containing it would naturally be colored yellow to brown. This is so true, that the reaction can be used to distinguish between cupro and viscose-silk.

Goetze has developed the silver-reaction to the stage of a quantitative method of determination of oxy-cellulose (Mell. Textil-Ber. ser. 1927). He designates as the silver number the weight of silver which is separated by 1 g. of the goods. According to his procedure, the value is determined by boiling the cut-up sample with silver nitrate solution containing sodium acetate, dissolving the separated silver in nitric acid, and titrating with N/100 ammonium thiocyanate. As in the case of the permanganate number, there is a fundamental value which has to be considered in the calculations.

The long-known Nessler's reagent, an alkaline mercury-salt solution, is less known as applicable to the determination of oxy-cellulose, although it is well adapted for the purpose. It is prepared by dissolving 7.5 g. of mercuric chloride and 16.5 g. of potassium iodide in 100 cc. of water and 80 g. of caustic potash in 400 cc. of water. Its use in the examination of damage in bleaching goes back to the observation of Ditz, that alkaline mercury solutions are reduced by oxy-cellulose. It had been, of course, in use long before, as a sensitive test for the presence of traces of ammonia in drinking-water. Goods containing oxy-cellulose give with Nessler's reagent a yellow color, which with increasing degree of damage goes over through orange to brown and finally to gray. The reaction is very sharp and sets in, even in the cold, in a very short time, and more rapidly on heating. It furnishes also a criterion of the degree of yellowing which the goods will probably suffer on storage or ironing. In the change of color, in the test, from yellow to gray, it is to be noted that alkali alone is able to produce yellowing upon over-bleached goods. The concentrated test-solution can be diluted to three times its volume, for use in the test. In this way its high alkalinity is diminished, and we also save on the amount of expensive reagent used.

Attention has recently been drawn to the use of alkaline mercury solutions through an article by Rhodes (J. Text. Inst.). He proposes a reagent prepared by adding 500 cc. of 3N caustic soda (120 g. NaOH/1) to a solution of 8 g. of potassium iodide and 10 g. of red mercuric iodide in 50 cc. of water; after standing over night, the solution is filtered through glass wool. The reaction with it is carried out by boiling the sample with the solution for 1 minute, then washing in 1% potassium iodide solution, and rinsing with water.

This work of Rhodes suggested to the author certain experiments, comparing this new reagent with the older Nessler reagent, especially in connection with the damage caused by over-bleaching, upon cotton. For this purpose, pre-bleached cotton was completely bleached with hypochlorite of 8 g. Cl per liter, then rinsed, scoured, and passed through a sodium thiosulphate bath. The duration of bleaching amounted to 5, 0, 15, 30 minutes, and 1, 2, 4, 8 and 24 hours. Portions of the different bleached materials gave with the solution a reaction which corresponded completely with the duration of the bleaching, beginning with a light-yellow color, finally passing over to gray in case of the swatches bleached for 8 hours. Nessler solution, in parallel tests, gives corresponding but weaker colors. Fehling's solution also, with 15-minute boiling, gives deposits which in strength are also completely parallel to the above results. The color-tests obtained were at first very clearly to be recognized, and were well suited for estimation of the amount of damage existing on the fiber. On drying the swatches in the air, however, the colors faded badly, and on long keeping disappeared completely, doubtless on account of the volatility of mercury and its salts. Experiment showed also that long washing of the stained swatches with water caused decided lightening of the tone of the stains. In experiments which were carried out exclusively in the cold, it was evident that warming is not necessary in this test. In the original procedure, the test should take place at the boil; but the reaction then proceeds rapidly, and leads to the formation of the gray even with slight amounts of oxy-cellulose. Then, too, it must be noted that even undamaged cotton assumes a pale gray color on being boiled with the concentrated solution. The Rhodes reagent is more sensitive than the Nessler, at the boiling-point.

Oxy-cellulose, on boiling of over-bleached goods with caustic alkali, dissolves to a large extent. It seemed of interest to ascertain whether oxy-cellulose could still be detected upon goods treated in this way. New samples, boiled for ½ hour with 3% caustic soda solution, still give a weak yellow with the Rhodes reagent, while they are no longer colored by the Nessler solution.

A further series of experiments was carried out under considerable diminution of the alkali-content of the Rhodes reagent. In preparing this modified form, the different reagents were prepared to contain respectively 80, 60, 40, 20 and 10 g. of NaOH per liter, instead of the original 120 g. The sensitivity of the reagent down to the 40 g. strength of caustic per liter was about the same as that of the original reagent. But the last two of the series, the 20 and 10 g. strengths, react essentially more feebly.

Rhodes lays chief emphasis upon the suitability of his reagent for examination of damaged viscose; but this fiber can dissolve in strongly alkaline liquids. The differ-

ence in alkali content between Nessler's and Rhode's reagents is not great; there is no striking difference in the results of the two. But the Rhodes reagent is particularly well suited for the detection of oxy-cellulose. Warming is not absolutely necessary, as a plainly visible reaction takes place even in the cold. The alkali content, as seen above, can be considerably diminished without loss of effectiveness.

Beside damage from bleaching agents, the action of strong acid upon cellulose—the formation of hydrocellulose—is a frequent cause of tendering of cotton. This substance, hydrocellulose, also reduces the above reagents. Of these, Fehling's solution has the most vigorous action; the others are less active. Experiments carried out by the author determined this in the case of Nessler and Rhodes solutions. Cotton was wetted out with dilute sulphuric acid of 0.1, 0.2, 0.5, 1.0, 2.0 and 5.0 g. per liter squeezed and dried for from 24 hours to 14 days at 40°C., and finally washed. While the reaction with Fehling's solution was very distinct, and appeared correlated with the duration of action and the concentration of the acid, the coloration produced with the two mercury test-solutions, while likewise correlative with time and concentration, was much weaker.

The local distribution of damaged areas of either kind upon the goods can be made plainly visible with the above reagents. The sensitivity is increased if the colored deposits upon the goods is observed under the ultra-violet lamp, since in this light the colored areas stand out much darker than in daylight.

Du Pont Announcement

E. I. Du Pont de Nemours & Co. has added Sulfogene Brown to their list of products. This color is said to possess good solubility and is suitable for dyeing in all types of machines. Dyed direct it is stated to have good fastness to ironing, rubbing, dry steaming, acids, ammonia, washing, mercerizing, water and perspiration. When aftertreated with copper, chrome and acetic acid the shade, according to the announcement, becomes bluer and the fastness to light, cross-dyeing and washing likewise becomes improved. This dye is claimed to give rich chocolate shades of brown redder than Sulfogene Cutches and much yellower than Sulfogene Bordeaux.

General Fast Blue BB Paste

The General Dyestuff Corporation has recently placed on the market another new developing agent, in Fast Blue BB Paste, which is described as of greenish character and very brilliant in shade. The accompanying announcement states that the product discharged white, is especially fast to chloride of lime bleach and boiling caustic, gives pleasing shades of greenish cast with Naphthol AS and AS-D grounds and very bright navy blues on AS-TR AS-BO, S-E, and AS-SW. It is particularly recommended for print-on-styles.

The same company has likewise distributed their card Sol. K. 33, which illustrates Indigosols printed on mixed fabrics of cotton and acetate silk.

National Aniline Releases

The National Aniline and Chemical Company, Inc., has announced the addition of two new dyes to their range of colors; National Alizarine Red S, a mordant dye, and National Solantine 8BL, of the Solantine Group. The former is said to have very good solubility, leveling, and penetrating properties. It is especially recommended for dyeing hard spun yarns and closely woven pieces. The latter resembles 8BLN in shade but is said to dye animal fibers almost the same shade as cotton, thus making it particularly useful in union dyeings.

New Carbic Color

A new dyestuff, Brilliant Fast Cyanine R, just brought out by Durand & Huguenin, S. A., has been announced by their agents, the Carbic Color and Chemical Co. This dyestuff is claimed to be the first chrome blue possessing all the properties required for cretonne printing and similar styles, viz. good fastness to light, chemick and hydrosulphite, and satisfactory to washing. It is recommended as producing exceptionally bright shades and also as readily mixing with Chromicitronines to give olive shades of good fastness to light.

Carbic has also sent to the trade a color card of Durand & Huguenin, S. A., showing Indigosols printed on mixed fabrics of cotton and acetate silk.

Custom House Guide Issued

The new sixty-ninth edition of the "Custom House Guide", compiled by Customs experts includes the new United States Customs Tariff Act complete and a special alphabetical index of twenty thousand commodities with their individual rate of duty. This exhaustive annual of foreign and domestic commerce will be particularly welcome at this time. The guide is edited by A. G. McCourt who for twenty-five years has been Acting Deputy Collector of the United States Customs. His assistant in the work is John J. Budd, well known student of commercial relations and publisher of technical customs books.

Japanese Imports of Dyes Lower

A dispatch from Consul Howard Donavan of Kobe states that the imports into Japan of dyestuffs decreased by 1,100,000 pounds, or 67 per cent by volume, and 56 per cent ($637,000) by value, during the first quarter of 1930 as compared with the same period in 1929. The domestic dye industry, which is subsidized by the Japanese government, is somewhat depressed according to the recently published report of the Japan Dyestuff Manufacturing Co. of Osaka.

Notebook on H Ion Measurements

Leeds and Northrup Co., manufacturers of electrical measuring instruments, have recently published a booklet entitled "Notes on Hydrogen Ion Measurements." The specific purpose of the note book is to furnish information that will be helpful to the large and rapidly increasing number of individuals interested in pH determinations.

The brochure gives a concise and comprehensive study of the theory, use, and scope of electrical hydrogen ion measurements. Part is the equivalent to a manual of operating directions; it tells not only what the apparatus is but how it is used and what its limitations are.

Color Correlation Chart

The Color Correlation Chart for the 1930 fall and winter seasons has been released to members, it was announced recently by the Textile Color Card Association.

In this chart, the leading color families for daytime and evening wear are grouped according to their cast, and for each group are suggested the fashionable shades in shoes, bags, hosiery and other accessories, which match, or smartly blend or contrast with the basic color note of the costume. The chart is to be used in conjunction with the various 1930 fall season cards for silks, woolens, shoes and leather and hosiery issued by the Textile Color Card Association.

The new browns, for example, are divided into mahogany browns, rose browns, purplish browns, tête de nègre and yellowish browns. Reds are classified as to rose reds, wine reds and ruby reds, while greens fall into tones of bluish or yellowish cast. The other main groups for daytime wear include blue, black, rust, beige, grey and purple. The ten basic colors for fall and winter 1930, selected by the Color Coordination Committee of the National Retail Dry Goods Association, are indicated in the chart, as well as all the shades chosen by the Associated Dress Industries of America and the Allied Millinery Associations.

A collection of smart bi-color themes constitutes a special feature of the chart. This offers suggestions for effecting smart color harmonies or contrasts between the various units of the ensemble. For example, a blouse of Rose Directoire may complement a costume in Wine-tone or a dress of Copper Laque may be worn with a coat in Bison Brown. The chart will serve primarily as a guide to retailers in effecting the correct color coordination in the various departments of the store.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED

Dyestuff Salesman with many years of Sales and Laboratory experience is desirous of a suitable position with Manufacturing concern. Advertiser has an extensive personal connection in various States and can give first-class references. Reply to Classified Box No. 608, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

As Boss Dyer on silk hosiery, F. F. or seamless. Capable of large production, good matching. First class reference. Location no object. Address Classified Box No. 614, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

Textile Chemist with nine years' experience in all departments of bleachery and print works seeks position with finishing plant or dyestuff manufacturer. Familiar with the application of all types of dyes and finishes on cotton and rayon piece goods. Address Classified Box No. 615, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

MASTER DYER

Eastern finishing plant handling cotton, rayon and silk piece goods has an opening for good man with thorough experience in vat dyeing and dyeing for discharge printing. No others considered. Technical training helpful. Application must state age, experience, and salary desired. Address Classified Box No. 616, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

FOLDING ROOM FOREMAN

Textile piece goods finishing plant near New York has opening for capable inspection and folding room foreman. Thorough cotton and rayon experience essential. Apply in writing, stating age, training and salary desired. Address Classified Box No. 617, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

Who is interested in services of a chemically trained salesman with established trade record of about one hundred thousand per year in dyestuffs and specialties? I desire new connection with responsible up-to-date manufacturer to introduce and develop sale on some new chemical, or specialty, or waste product to the mill trade on salary, expense and commission basis. Address Classified Box No. 618, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

As Boss Dyer on Full Fashion Hosiery capable of large production, excellent matchings. First class reference, location in and around New York. Address Classified Box No. 620, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.